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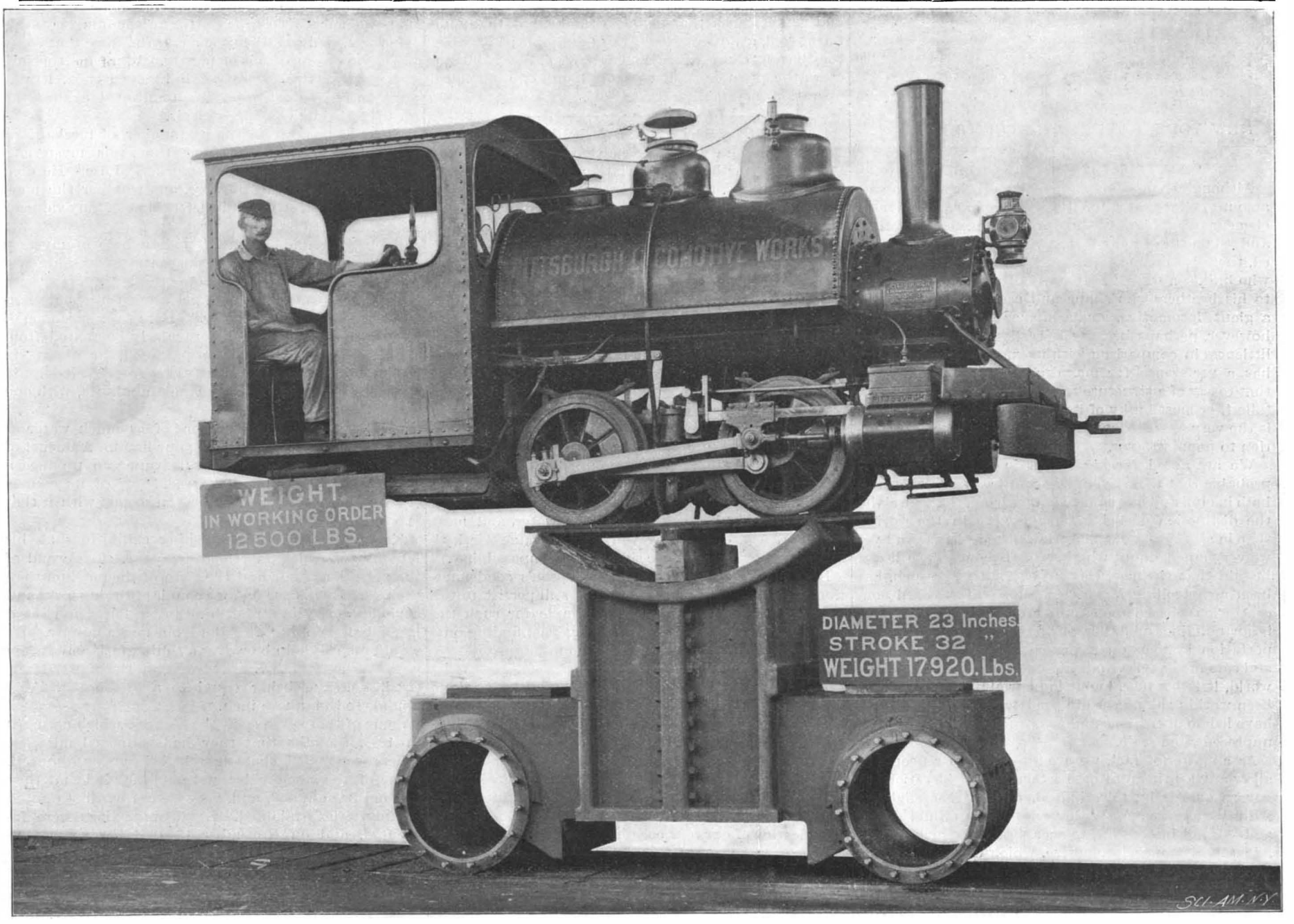
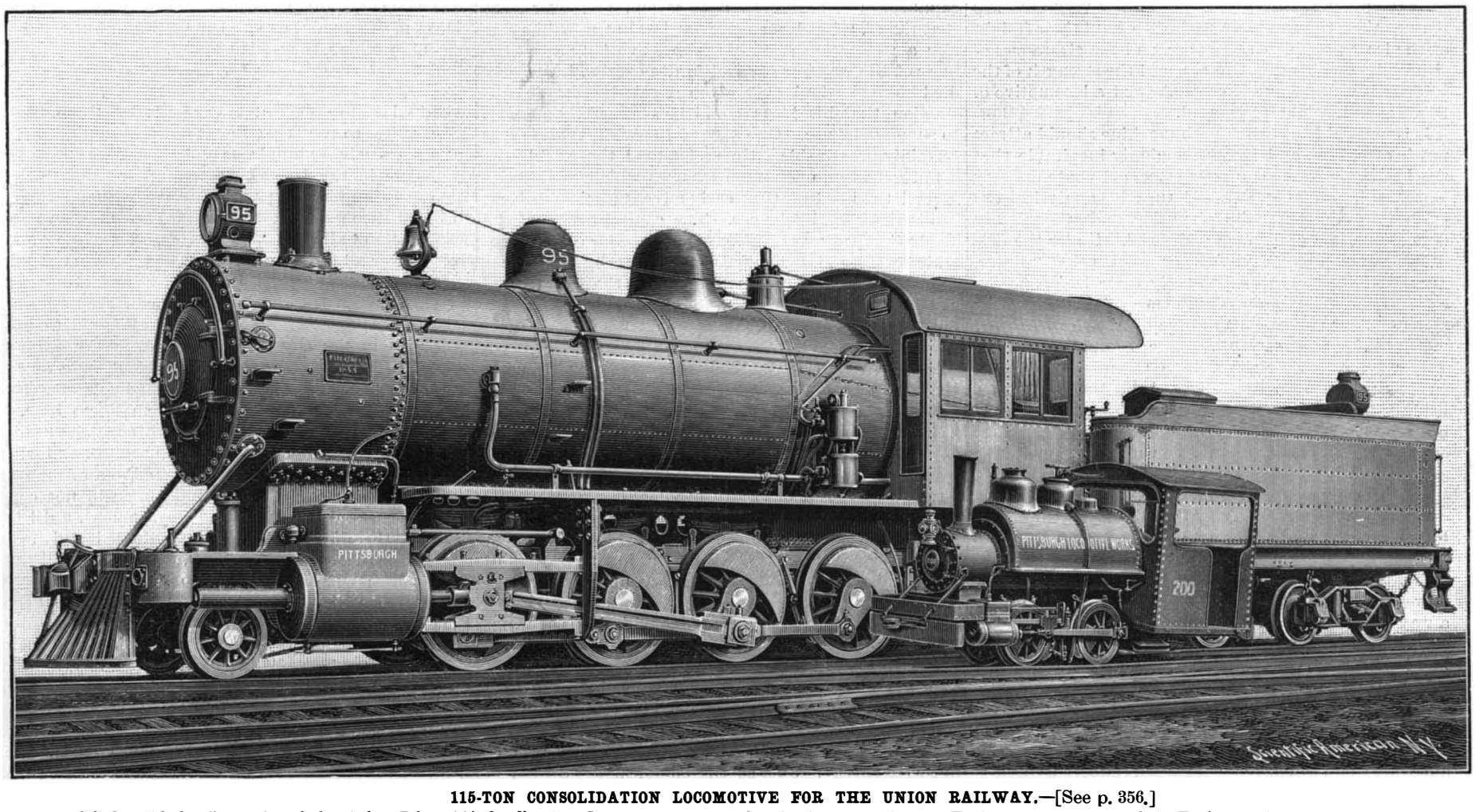


YARD ENGINE MOUNTED ON CYLINDERS OF CONSOLIDATION LOCOMOTIVE.
Yard engine boiler, 24 inches diameter. Locomotive cylinders, 23 inches diameter.



115-TON CONSOLIDATION LOCOMOTIVE FOR THE UNION RAILWAY.—[See p. 356.]
Cylinders, 23 inches diameter by 32 inches stroke. Drivers, 54 inches diameter. Steam pressure, 200 pounds. Tractive power, 26½ tons. Heating surface, 3,322 square feet. Hauling capacity on level, 6,650 tons.

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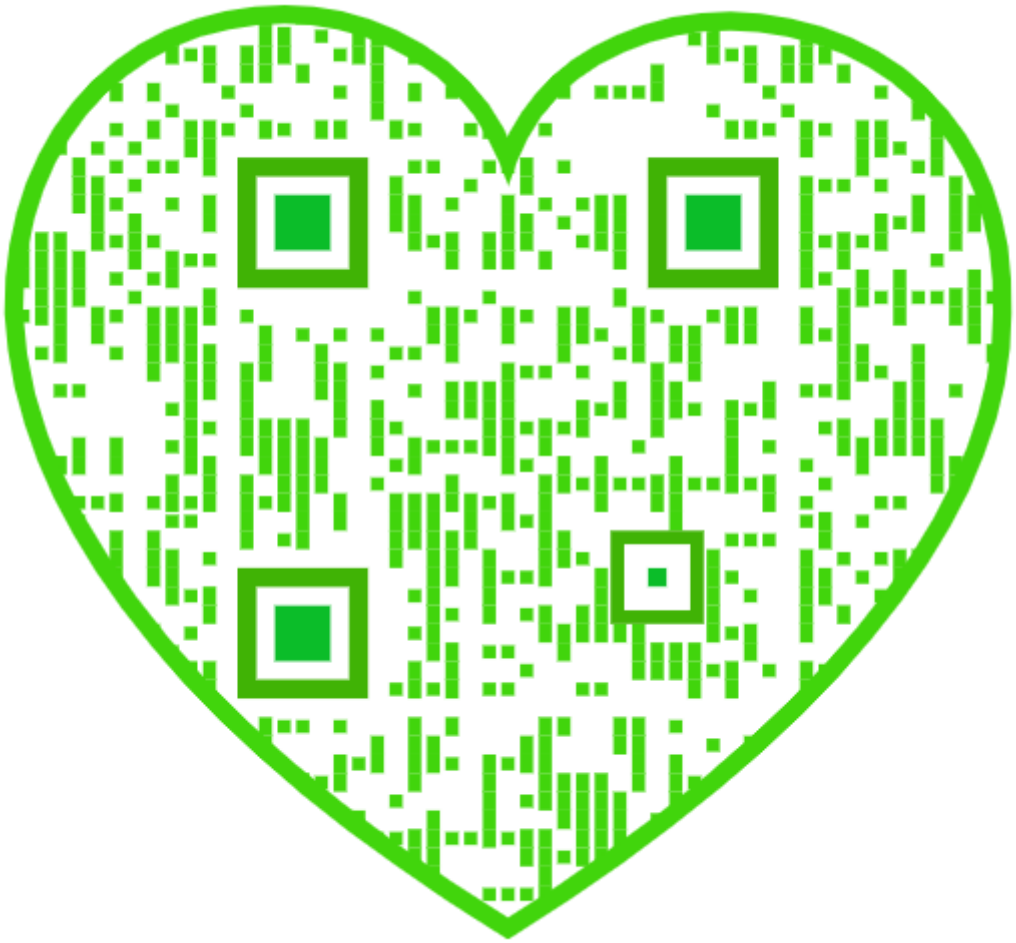

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NEW YORK, SATURDAY, DECEMBER 3, 1898.

"THE BIGGEST IN THE WORLD."

Although there is no particular merit, there is a vast amount of interest and curiosity attaching to the mere element of "bigness" in engineering construction. Judged on the ground of the skill and ingenuity required, there is as much credit to be given to the mechanic who builds a watch of the size of a ten cent piece as to his brothers who shape and assemble the parts of a giant locomotive, steamship, or bridge. Mankind, however, perhaps because it realizes its own material littleness in comparison with its natural surroundings, has a preference for magnitude, and it would seem that to say of a structure that it is the biggest, longest, tallest, or most bulky of its kind in the world is to give it the very best credentials for an immediate introduction to popular favor.

We are noted for big things in America, and it is probable that there are in this country more structures, both in civil and mechanical engineering, that can claim the distinction of being "the biggest in the world" than in all the rest of the world put together. And yet we very much doubt whether in any single case it can be said that the mere element of bigness, as such, has been a controlling factor. The tendency toward concentration is based upon sound economic principles, and if our buildings are taller, our power stations and transportation systems on a vaster scale, our locomotives and cars far heavier than those found elsewhere in the world, it is because, in our industrial pursuits, we have been working along certain predetermined lines which have led to operations and constructions of a vast and unprecedented scale.

As a matter of fact, we are too practical a people to allow any sentimental or spectacular considerations to govern our designs or, indeed, exercise the slightest influence upon them. We have not built an Eiffel Tower and it is not likely that we ever shall. Huge machines like the Pittsburg locomotive, which we illustrate this week, are big because we have found that it pays to make them big. The Pittsburg Consolidation weighs nine tons more than the Great Northern mountain locomotive, not because the Carnegie Steel Company wished to "beat the record" by possessing the biggest freight engine in the world, but for the very practical reasons that the company wished to haul their freight at the least possible cost per ton, and the clearances of the road on which it was to run and the strength of the bridges it would have to cross allowed a locomotive of this size and weight to be used.

It is natural that this superb machine should attract much attention, and it was seemingly inevitable that the locomotive expert of our esteemed contemporary The London Engineer should turn his analytical eye upon it, and rebuke its obtrusive and unnecessary dimensions in a two-column editorial. Under the title of "Monster Locomotives," he complains that "clever, irresponsible amateurs continually write letters urging on British railway companies the necessity—which they assume to exist—for the adoption of American railway methods in this country." The complaint is well founded, for, as we showed in a recent issue, the restrictions to size on English roads, in the way of low bridges, narrow tunnels, and bridges of limited carrying power, are such as to prohibit the use of the huge express and freight engines which are common in this country.

Our contemporary falls, however, into the common error of supposing that we take pleasure in building big locomotives for the mere sake of their bigness. "Is there," it asks, "much or anything to be gained by making locomotives more powerful than they are now—not as regards the mere conduct of traffic, but in a way that concerns the locomotive regarded merely as a machine?" Consciously or unconsciously, the writer has here stated the broad line of distinction between the methods of English and American locomotive builders. We have always designed our engines with a strict regard to "the mere conduct of traffic," and have troubled ourselves very little with the performance of the locomotive "regarded merely as a machine." We have found that the locomotive with liberal grate surface, large heating surface, free steam passages, and drivers of moderate dimensions will haul the greatest loads for the least expense of operation. Coal consumption is only one of many items of expense, and hence we have cared very little whether the type burnt 20 pounds or 70 pounds of coal to the mile in doing its work, so long as this ultimate economy was secured. The school which The Engineer represents is, or rather has been, too much occupied with the performance of "the locomotive regarded as a machine," and in its desire to build locomotives that would show a small coal bill and good laboratory results, they have taken altogether too narrow a view of the question. Slow piston speed, a mild exhaust, small fuel consumption, and smokestacks that emit no smoke, not to say unburnt coal, are theoretically very desirable; but when they mean "short trains" and double expenses for train crew, the practice from the standpoint of economical operation is certainly extravagant.

THE PROPOSED NEW MONITORS.

Unless Secretary Long and Congress take up the matter of a further appropriation for modifying the original designs, the country will be committed to the folly of building four vessels of the discredited monitor type. The Naval Board, acting under the instruction of the secretary to improve the monitor plans to the extent of removing the objectionable monitor features, has decided, after conferring with the four shipbuilding firms which had secured the contracts, to improve the vessels by lengthening them 27 feet, thereby increasing the coal supply from 200 to 400 tons and providing better accommodation for the officers and men. The displacement, moreover, is to be raised from 2,700 to 3,000 tons.

Now, while this is good as far as it goes, it does not go far enough. The monitors are monitors still, with the most vicious features of that antiquated type still existing, and the others merely modified. The improved (?) vessels will have the same low speed of 12 knots (trial speed, equal to eight or nine in service), they will sit monitor fashion, squat upon the water, and most serious defect of all, they will be the same "jerky" rollers, rendering accurate shooting an impossibility.

How the Board, with Admiral Sampson's condemnation of the type in its hands, should still persist in the advocacy of monitors, pure and simple (for such the amended boats will be), is something past finding out.

If it is found that with the amount appropriated it is impossible to build four coast defense vessels, with fair speed and seaworthy qualities, the obvious course, having in mind the failure of the monitors in the war, is to draw up new plans and request a further appropriation to cover the increased cost.

It is sincerely to be hoped that the same farsightedness which led Secretary Long to urge the increase of speed in our latest battleships will cause him to push forward the matter of a further appropriation for the modification of our new coast defense vessels.

DEATH OF JOHN KEELY.

With the death of John W. Keely, one of the most curious delusions of the nineteenth century passes away. Over thirty years ago Keely announced that he had discovered a mysterious power of immense capabilities of industrial application, and ever since that time he has been more or less in the public eye. For a generation scientific men have laughed at the news of the wonders of Keely's discoveries, but Keely died before he had ever given a satisfactory demonstration that his ideas could be successfully adapted to commercial use. One part of Keely's invention was certainly practicable. He understood thoroughly the art of getting money upon schemes which would have turned the head of that early adventurer, John Law, in his Mississippi Schemes. The capitalization of the Keely Company was $5,000,000, and, so far as his counsel knows, no statement has been left by Keely that discloses the secret of his motor, and the only legacy of the corporation may be the mechanical apparatus in the Keely workshop, minus the secret by which it might be operated.

In some respects Mr. Keely was a remarkable man. He was an expert in the theory and art of music, and he was not only an instrumentalist, but a composer as well, and was, by reason of his attainments in this line, enabled to find the primary element of his alleged discovery. This was supposed to be a relation or affinity between the forces of nature and harmonic forces. He said he discovered a sympathetic vibration connecting the waves of sound with the disturbance in molecules of matter, and also found in the process of this peculiar disturbance an energy unknown to the sphere of dynamics.

His first experiments were made with drops of water in a vacuum. The first mechanical property he developed from this series of experiments was the force of adhesive attraction, which he assumed, in his own statements, to be related to the polar currents of the earth. Next he alleged that he had developed the force of propulsion, revealing a positive as well as negative energy. Just as the chemical separation of the molecules of water produce electro-magnetism, he adopted the theory that he could disintegrate molecules by the sympathetic vibration of tones producing a subtle and higher force correlated with magnetism. He made startling propositions relative to the rotation of planets, etc., and many other equally wild and chimeric ideas.

About twelve years ago he abandoned his experiments upon the molecules of water as the basis of his tests and directed his attention to the molecules of the air. He stated that he could produce a dynamic energy of 10,000 pounds to the inch in a Torricellian vacuum. He gave some experiments at the Sandy Hook Proving Grounds, in 1888, in the presence of a number of skeptics. Keely declared he could exhaust the air from a tube, getting a vacuum very nearly perfect, and could thus generate a force that could fire a gun or move tons of matter. Whatever the substance was that Keely carried in his steel tube, it was apparently inexhaustible, which militated against the idea that he used compressed air.

Keely devised an enormous number of mechanisms to aid in convincing skeptics that this mysterious atomic energy could be put to practical use. He died without effecting this purpose, and whether the mass of the manuscript which he left will be of any value or not, remains to be seen.

Keely surrounded himself with a halo of mystery and worked for a long time in the most absolute secrecy, making extravagant claims and promises as to the miracles which he would perform with his mechanism "inter-etheric liberator." Here is a specimen of one of the bulletins which regularly emanated from the laboratory. In 1875 he proposed, in about six months, to run a train of thirty cars from Philadelphia to New York, at the rate of a mile a minute, with one small engine. He said:

"I will draw the power all out of as much water as you can hold in the palm of your hand. A bucket of water contains enough of this vapor to produce a power sufficient to move the world out of its course. An ordinary steamship can be run so fast with it that it would be split in two."

Keely used to give astonishing exhibitions at his laboratory, which mystified everyone. The wand of the prestidigitateur and the slate of the medium were exchanged in his person for a couple of tuning forks and a violin bow. He struck his tuning forks and set a brass ball running at 600 revolutions a minute. He would rasp a violin bow over a tuning fork and the apparatus would raise a heavy weight, the power exercised, he said, being equal to a pressure of 25,000 pounds to the square inch.

Some of those present at the séances, which occurred in 1885, thought that they had witnessed miracles, others concluded that they had been humbugged. Some of the stockholders were not satisfied that they had not been duped, and, very naturally, they wanted the mysteries explained. Legal proceedings were instituted, and on November 17, 1888, Keely was committed to jail for contempt of court in refusing to obey an order to explain the workings of his machine to a committee of experts. He did not, however, remain in jail very long. To the very last he never failed to get financial support, which enabled him to live very comfortably and pay for all his experiments.

The SCIENTIFIC AMERICAN regularly took up the claims of Keely and exposed the fallacy of the principle upon which they were based.

CONDITIONS IN PORTO RICO.

United States Consul Hahna, at San Juan, Porto Rico, writes to the Department of State as follows:

"I am receiving hundreds of letters from all classes of people in the United States, asking about Porto Rico. Most of these persons say they intend coming to Porto Rico for work or to go into business, and they want to know all about the country. To go into detail and answer all these hundreds of letters would require the services of several clerks; but I have said to nearly all these inquirers that no American seeking work should come to Porto Rico. I have also said to business men in the United States that, in my opinion, they would be disappointed if they came here now to establish themselves; that the time had not yet arrived for an American to go into business in Porto Rico. I believe the time will come when this will be a good field for the investment of American capital, and when nearly all kinds of business conducted in an American style will be profitable; but that time will not come until the island has American government, until the laws of the United States are enforced and tariff changes made. Then, I believe, this island will take on new life; but our people who think of doing business in Porto Rico should be made to understand that the existing high duty on American products prohibits their shipping building material, machinery for factories or plantations, etc., or establishing any kind of business with profit. Most of our business men who have come here simply look the island over, pronounce it rich and possessing golden prospects for the future, but decide that it is too early to invest. The American press should inform our merchants and business men of the true situation."

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INDUSTRIAL PROPERTY COMMISSION.

In our issue for November 19 we referred editorially to the "Commission to Revise the Patent and Trade Mark Laws of the United States." All of the three sessions were successful, and the forthcoming report will be looked for with interest. The first session was held in the Federal building, New York city, November 19. There were present the chairman of the commission, Mr. Francis Forbes, and Judge A. P. Greeley, Assistant Commissioner of Patents; the third member, Judge P. S. Grosscup, of Chicago, did not arrive from Chicago in time to attend the meeting. Mr. Forbes made a short opening address explaining the scope of the commission. Mr. Israel F. Fischer, Member of Congress, was the first speaker, and he dealt largely with regional marks, such as "Port," "Madeira," "Burgundy," etc., showing that the use of many so-called regional brands of wines or liquors is not intended to designate the places of origin or manufacture, but are simply terms which have grown up in the trade, and to prevent the use of such words by manufacturers would be to discriminate in favor of foreign manufacturers.

Mr. A. L. Pincoffs, an attorney of New York, replied to Mr. Fischer, claiming that there should be some restriction placed upon manufacturers to prevent them from using labels designed to copy those used by foreign makers. Among the other speakers were Thomas Drew Stetson, Herbert A. Banning, and Dr. F. E. Stewart also addressed the commission relative to caveat laws and trade marks used by manufacturers of proprietary articles. Dr. Stewart, who is Chairman of the Committee on Patents and Trade Marks of the American Pharmaceutical Association, spoke of the attempt to create a perpetual monopoly for secret medicines through registration of trade marks, registering the only name by which the article is known and obtaining protection in case of a term really generic, thus creating a patent in effect without giving the public the consideration demanded in case of a patent—publicity after a certain period had elapsed. Judge Greeley referred to the matter of oaths to applications and the proper officers abroad before whom they may be made. He also referred to the suggestion as to advisability of requiring applicant in this country to elect a domicile and appoint representatives on whom notice of legal proceedings can be served.

The second session was held at New York on November 21, Mr. Forbes and Judge Greeley being present. Mr. Frederick P. Fish, counsel for the General Electric Company and the Bell Telephone Company, thought that our patent system was the best in the world and that the caveat might be abolished without injury. Mr. Albert H. Walker also contended that the caveat should be abolished. Mr. W. L. Cliffe, of Philadelphia, Chairman of the Committee on Patents and Trade Marks of the Pennsylvania State Pharmacal Association, made a statement in regard to chemical patents to foreigners, which he opposed. Mr. E. N. Dickerson defended the taking of chemical patents in this country by foreigners, and especially by Germans, whose country gave patents for processes, but not for a chemical composition, although it would be protected by the patent for the process if no other process was discovered. Dr. F. E. Stewart again spoke and read resolutions passed by his Association condemning the laws which protected pharmaceutical preparations by patents and also which gave a monopoly to the owners of secret preparations by means of trade marks. Mr. Dickerson subsequently renewed his argument and claimed there was no difference between a patent for a medical truss and a patent for phenacetine, and that patents for medicinal substances should be protected as a benefit to humanity equal to patents for mechanical devices.

Mr. Dickerson agreed with Dr. Stewart that if a patented article had only one name by which it was known, that that name should become common property when the patent expires. Dr. R. J. Gatling made an interesting address on the advantages of patents as suggestions to inventors, even though the devices patented were inoperative. Mr. D. W. Brown advocated the retention of the caveat. Mr. Lemuel W. Serrell contended that the caveat should be extended to foreigners.

The third session was held in Washington, November 22, in the office of the Commissioner of Patents. Representatives of the patent bar gave their views. The sentiment was, on the whole, in favor of abolishing caveats. Another question discussed was in reference to interference proceedings by foreigners. It was contended by some that the foreign inventor should be given the date of his first foreign application as a date equivalent to the date of a United States application instead of the date of issue of his foreign patent as now. Another proposition involved the reduction of the fees required upon the filing of an application for the registration of a trade mark. Under the present law, in case registration is refused, because of conflict with prior existing registered works, the fee is lost, and as the expense connected with the registration is slight, it is contended by some practitioners that the fees should be reduced to somewhere between $5 and $10.

The question of the reduction of fees on patents was also considered. It is thought by many attorneys that a reduction would stimulate business and result in a large increase in the number of applications filed.

In the afternoon the Commission as a body paid an official visit to President McKinley, and in the long interview granted them the President showed that he was keenly alive to the questions before the commission as related to foreign commerce.

The next day was spent in discussion of the letters received and in drafting the formal report. The report is expected to be ready before the meeting of Congress, and we shall duly notice it when it becomes public. The chairman, Mr. Forbes, will still be glad to receive letters bearing upon the subject as outlined in the circular letter.

THE HEAVENS IN DECEMBER.

BY GARRETT P. SERVISS.

The advance of the winter constellations up the eastward slope of the sky during December is one of the most sublime spectacles that the heavens afford to the contemplation of the earth's inhabitants. Taurus, as forerunner of the great company, appears early in the evening, rising with a backward motion, like a leader turning to face his marching orchestra, with the swarming Pleiades a-glitter on his shoulder and Aldebaran glaring red beneath the upraised club of Orion. Behind his back, and high overhead, are Pegasus and Andromeda, while Auriga, with the brilliant Capella, outrivaling Aldebaran in splendor, keep abreast of him in the northeast. Between Auriga and Andromeda soars Perseus, hero of the diamond sword and winged sandals, with Cassiopeia close by, toward the pole. In the meantime, Cygnus, Lyra, and Aquila are retiring adown the western sky, the Northern Crown is poised on the horizon, and Ursa Major shines under the pole. An hour later, Orion and Gemini, advancing with even stride, having the Galaxy stretched between them, appear in the east and northeast, and with their coming a shimmering light seems to break over the sky. Orion, on a clear night, flashes with extraordinary brilliancy. His two great first magnitude stars, Rigel and Betelgeuse, with their contrasted colors; his glowing Belt, which was once the constellation of Napoleon, and the glittering surroundings of his wonderful nebula all uniting to accentuate his magnificence. Still later, following Orion and Gemini, appear Cancer, with its beehive cluster of stars (now honored with the presence of the planet Mars), Canis Minor, with the great star Procyon, and, chief over all the starry host, imperial Sirius, a star so great and splendid that it alone stands for a whole constellation, and outranks even Orion with all his celestial jewels.

These constellations afford a feast of beauty and many dazzling surprises for the observer with an opera glass. Let the glass be of the first quality and not too small, and look especially at the Pleiades, the Hyades (of which Aldebaran is chief), the Belt of Orion, and the neighborhood of the Great Nebula.

THE PLANETS.

Mercury is an evening star and can be best seen about the 3d, when it attains its greatest eastern elongation. It would be more conspicuous in the sunset but for its great southern declination. It moves from Sagittarius into Ophiuchus and passes between the earth and the sun on the 21st, after which it will be a morning star, but not visible until January.

Venus, which was so brilliant in October and the first part of November, passes between the earth and the sun on the 1st, and becomes a morning star. She remains in Scorpio throughout the month.

Mars is attracting attention once more, glowing with his characteristic reddish hue, and rising, at the opening of the month, between 8 and 9 o'clock in the evening. He is in the constellation Cancer, and was conspicuous to the eyes of all who watched for the Leonid meteors in November. The earth is rapidly approaching him and he doubles his brightness between the 1st and the 31st. The planet's north pole is inclined toward the earth.

Jupiter, in the constellation Virgo, is a morning star, rising at the beginning of the month about 4 A. M., and at the end about 2 A. M.

Saturn, in the constellation Ophiuchus, is in conjunction with the sun on the 6th, after which date it becomes a morning star.

Uranus, in Scorpio, is a morning star, but too close to the sun to be visible.

Neptune, in Taurus, just above Orion, is well placed for observation with telescopes, being in opposition to the sun on the 15th.

THE MOON.

December opens with a waning moon, which reaches third quarter on the morning of the 6th. The new moon of the month occurs on the morning of the 13th, the first quarter on the evening of the 19th, and the full on the evening of the 27th.

The moon is in perigee on the 14th and in apogee on the 2d and the 29th.

The lunar conjunctions with the planets occur as follows: Mercury, the 3d; Jupiter, the 10th; Venus, the 12th; Uranus, the 12th; Saturn, the 12th; Mercury, the 14th; Neptune, the 26th; Mars, the 30th.

MISCELLANEOUS.

There will be a partial eclipse of the sun, invisible, on the 12th, and a total eclipse of the moon, visible, on the 27th, the moon rising in eclipse.

The sun enters Capricorn, and astronomical winter begins, on the 21st, about 2 P. M.

A small meteor shower, radiating from Gemini, occurs on the night of the 10th.

Minima of the variable Algol occur on the 7th at 6:54 P. M., and on the 24th, at 11:47 P. M.

RECENT DEVELOPMENTS IN SCHOOL SANITATION.

The drinking cups of schoolhouses have, for a long time, been recognized as a means of spreading diphtheria and other contagious diseases. For the last quarter of the school year of 1897 the New York city schools excluded 4,183 children, and of this number 265 cases were for ailments which were liable to be communicated by the use of a common drinking cup, for diseases such as diphtheria, scarlet fever, whooping cough, and the mumps. Of other diseases more or less liable to be spread by the same means were measles, chicken pox, and 702 contagious diseases of the eyes. In the same relation to the adults are the drinking cups and tumblers used in public places where persons afflicted with consumption and all kinds of contagious diseases use the cup or glass indiscriminately. The Sanitarian recently described an ingenious drinking fountain invented by a citizen of Rochester, N. Y., which, if it came into general use, would soon supplant the use of cups and other drinking vessels in public places. It consists of a marble pedestal about 3½ feet high, capped with a funnel-shaped basin 12 inches in diameter. Upon applying pressure to a lever at the base of the basin a jet of water shoots up from the center of the basin and into the mouth when held over it. With a little practice one's thirst may be abundantly satisfied without the intervention of a drinking vessel of any kind. The jet is arranged so as not to spatter. This device admits of no contact of the lips with the jet pipe or any other portion of the apparatus, the water flowing through the supply pipe, through the jet directly into the mouth, and all the waste into the bowl, where it immediately flows off by an escape pipe. None is allowed to accumulate. If it is to be used by small children, wooden steps at one side enable even the smallest child to obtain an adequate supply of water to slake his thirst.

PHILIPPINE TOPONYMY.

According to Mallet, the island of Luzon was so called because its Spanish conquerors observed that in front of the cabin of every inhabitant there stood a large cylindrical wooden mortar, which, in the language of the Tagalas, was called a losong, and in which was pounded the rice that formed, and still forms, the staff of life of these people.

The name Manila (or Mainila as it has been spelled) is supposed to be compounded of the two Tagala words, ma, an apocopated form of mairon, "(where) there is," and nila, the name of a shrub (Ixora manila) of the order Cinchonaceæ, which grows in great abundance on the shores of the Bay of Manila.

The name Cavite is a very slight alteration of that of a native village, which was so called from the shape of the bay upon which it stood, the Tagala word cavit meaning a "hook" or "bend."

The Visaya or Central Philippine Islands derive their name from their inhabitants, who, at the time of the arrival of the Spaniards, had the custom of painting their entire body in different colors. The Spanish name is from the native word "bisaya," meaning "painted man."

SIR JOHN FOWLER.

Sir John Fowler, who was engineer-in-chief of the Forth Bridge, and, for his services in this connection, was created a baronet in 1890, is dead. Sir John Fowler was born in Sheffield in 1817; he began his career as a hydraulic engineer, working in the construction of the Sheffield water works. He then became assistant engineer in the construction of several lines of railway, among others the London and Brighton Railway. At the age of twenty-seven he was appointed constructing engineer of the Manchester, Sheffield, and Lincolnshire lines, the building of which presented peculiar difficulties in the way of tunnels, viaducts, bridges, hydraulic works, ferries, etc. His successful work soon brought him to the front rank of practical engineers. His services were widely sought both in England and on the Continent in the construction of railways and docks, and other large work requiring a large degree of engineering skill. The engineering feat by which Sir John Fowler is best known, both to the general public and engineering experts, is the construction of the great bridge across the Firth of Forth.

GERMAN university students have increased in number from about 10,000 twenty-five years ago to 32,241 last year. The increase is out of proportion to the population.

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ANOTHER MAMMOTH LOCOMOTIVE.

The locomotive which we illustrate this week is unquestionably the most powerful ever constructed. As we have shown elsewhere, the continually increasing size of American engines is due to the desire to secure the most economical results in operation. As between the policy of hauling a heavy train with a single engine or two light trains with light engines, there is, in the former case, a saving of the expense of a complete train crew. Further advantages, at least on tracks where the traffic is heavy, result from the reduction of the number of separate trains in operation.

The two locomotives of the type shown have recently been built by the Pittsburg Locomotive and Car Works for the Union Railroad Company, Pittsburg. They are at work on a short stretch of line between Munhall and North Bessemer, Pa., which forms part of the Carnegie system and connects the Duquesne Furnaces, Homestead Steel Works and the Edgar Thomson Steel Works. Four miles of the line are built on a grade of 70 feet to the mile and another stretch of the road (about 2,000 feet) is built on the unusually heavy grade of 2·7 per cent.

We are informed by Mr. D. A. Wightman, the general manager of the Pittsburg Locomotive and Car Works, to whom we are indebted for the photographs from which our engravings were prepared, that, owing to the great amount of wet weather since these locomotives went into service, the company have been unable to secure any reliable data of their performance in actual service on the various grades of the road.

The estimated tractive force, however, is 53,280 pounds and the estimated hauling capacity on a practically level track is about 6,650 tons. Now, just what these figures mean can perhaps be best understood by expressing them in other terms. The accompanying sketch, which is, of course, purely imaginary, shows what an engine with a drawbar pull of 26½ tons could accomplish in the way of lifting dead weight. The locomotive slung in chains represents a passenger engine of the average size used in this country thirty to forty years ago. If a cable were passed from the slings over a pulley and carried to the drawhead of the tender of one of these Pittsburg consolidations, she would be able to raise the smaller locomotive by direct pull without the use of any kind of purchase.

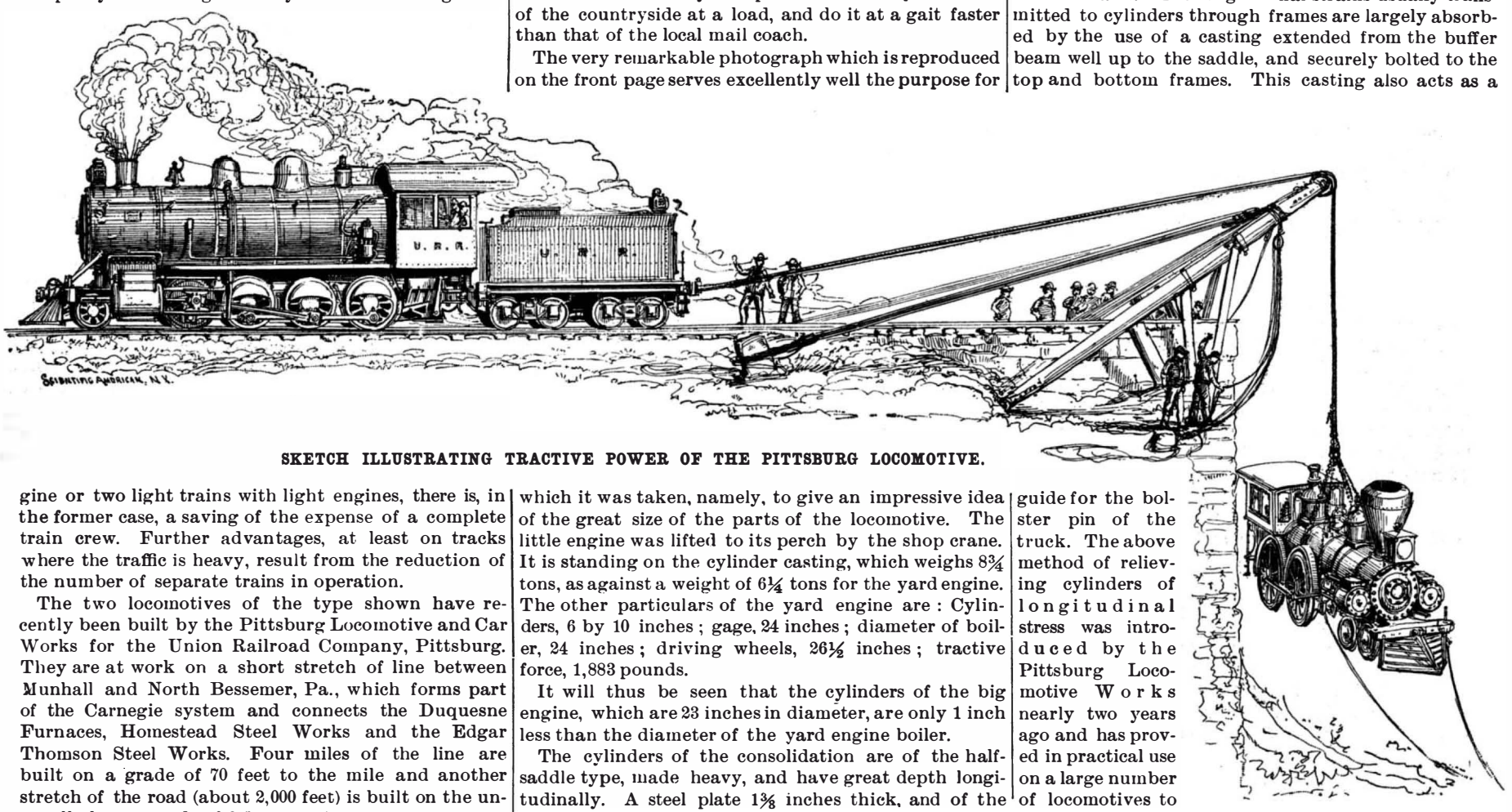
The hauling capacity on a level of 6,650 tons represents a train of 166 box cars loaded with wheat. The total length of such a train would be 5,700 feet, or considerably over a mile, and the wheat would represent, at an average of 15 bushels to the acre, the product of 9,000 acres, or over 14 square miles of land. And this enormous load could be taken over the road, or rather the level portions of it, at a comfortable speed of 10 miles an hour.

He would have seemed a bold prophet to our forefathers who would have dared to foretell that at the close of this century we should have steam horses that could cart away the products of 14 square miles of the countryside at a load, and do it at a gait faster than that of the local mail coach.

The very remarkable photograph which is reproduced on the front page serves excellently well the purpose for which it was taken, namely, to give an impressive idea of the great size of the parts of the locomotive. The little engine was lifted to its perch by the shop crane. It is standing on the cylinder casting, which weighs 8¾ tons, as against a weight of 6¼ tons for the yard engine. The other particulars of the yard engine are: Cylinders, 6 by 10 inches; gage, 24 inches; diameter of boiler, 24 inches; driving wheels, 26½ inches; tractive force, 1,883 pounds.

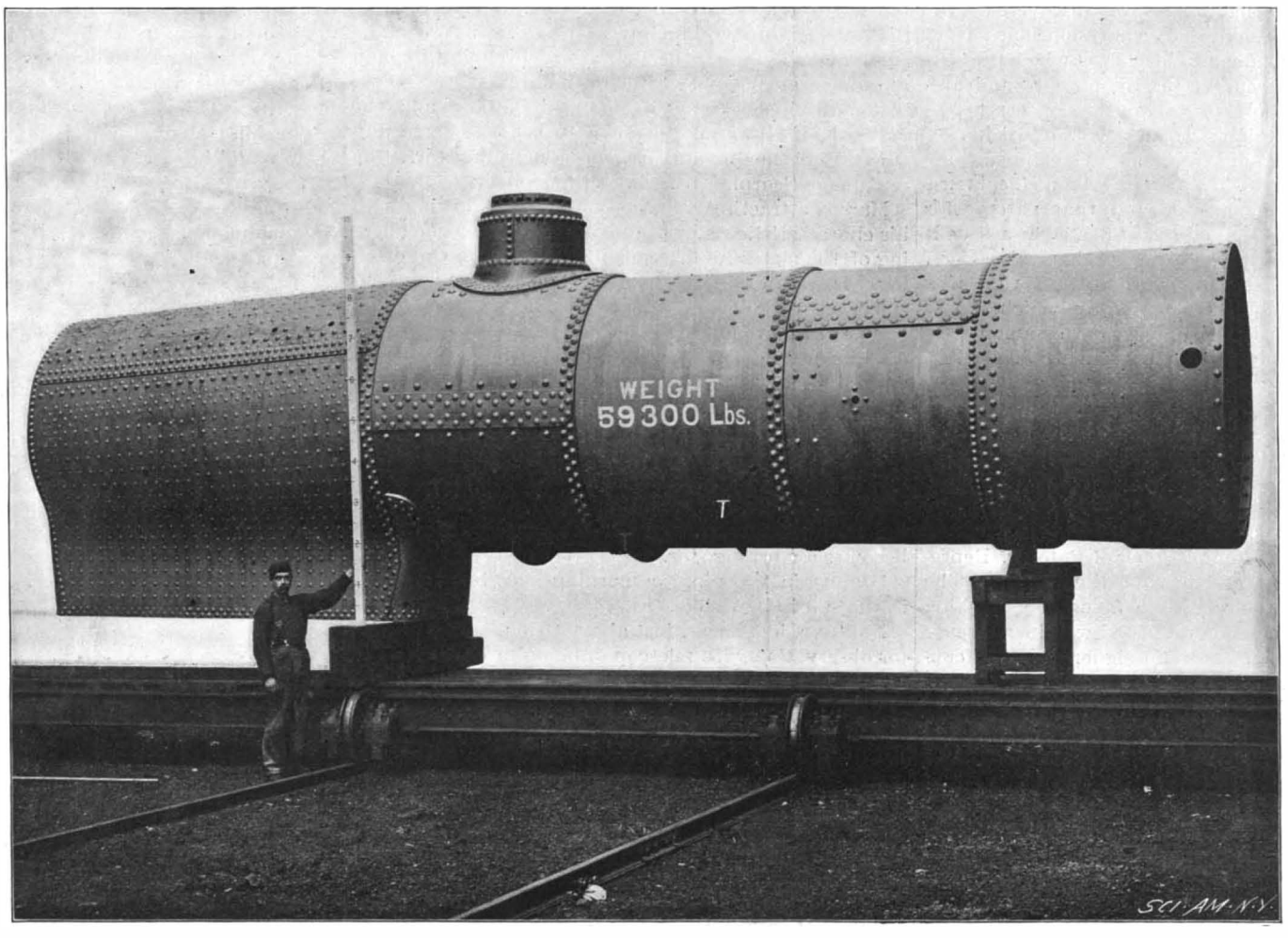
It will thus be seen that the cylinders of the big engine, which are 23 inches in diameter, are only 1 inch less than the diameter of the yard engine boiler.

The cylinders of the consolidation are of the half-saddle type, made heavy, and have great depth longitudinally. A steel plate 1⅜ inches thick, and of the same width as the bottom of the saddle, extends across and is bolted to the lower frames, and to this plate, as well as to the frames, the cylinders are securely fastened. Heavy bolts passing through the top frame bars at the front and back of the saddle form additional transverse ties, and relieve the saddle casting from all tensile strains. The longitudinal strains usually transmitted to cylinders through frames are largely absorbed by the use of a casting extended from the buffer beam well up to the saddle, and securely bolted to the top and bottom frames. This casting also acts as a guide for the bolster pin of the truck. The above method of relieving cylinders of longitudinal stress was introduced by the Pittsburg Locomotive Works nearly two years ago and has proved in practical use on a large number of locomotives to be of great value in reducing the breakage of saddle castings. The frames are 4½ inches wide. They were cut from rolled steel slabs made by the Carnegie Steel Company and weigh 8½ tons per pair, finished.



SKETCH ILLUSTRATING TRACTIVE POWER OF THE PITTSBURG LOCOMOTIVE.

	Decapod Tank Locomotive, St. Clair Tunnel.	Decapod, Erie.	Twelve-wheel Locomotive Northern Pacific.	Pennsylvania, Class H—5, Consolidation.	Twelve-wheel Locomotive, Great Northern.	Pittsburg Consolidation.
Name of builder	Baldwin.	Baldwin.	Schenectady.	Penn. Railroad.	Brooks.	Pittsburg.
Weight on drivers, pounds	180,000	172,000	150,000	177,000	172,000	208,000
Weight, total	180,000	195,000	186,000	198,000	212,750	230,000
Heating surface, firebox	193·0 sq. ft.	234·3 sq. ft.	206·5 sq. ft.	197 sq. ft.	235 sq. ft.	205·5 sq. ft.
Heating surface, tubes	2,218·8 sq. ft.	2,208·8 sq. ft.	2,721·6 sq. ft. Water tubes, 15 3	2,720 sq. ft.	3,045 sq. ft	3,116·5 sq. ft.
Heating surface, total	2,411·8 sq. ft.	2,443·1 sq. ft.	2,943·4 sq ft.	2,917 sq. ft.	3,280 sq. ft.	3,322 sq. ft.
Grate area	38·6 sq. ft.	89·5 sq. ft.	35·0 sq. ft.	.....	34 sq. ft.	33·5 sq. ft.
Drivers, diameter	50 in.	50 in.	55 in.	56 in.	55 in.	54 in.
Cylinders, diameter	22 in.	16 and 27 in.	23 and 34 in.	23·5 in.	21 in.	23 in.
Cylinders, stroke	28 in.	28 in.	30 in.	28 in.	34 in.	32 in.
Working steam pressure, pounds per square inch	160	180	200	185	210	200
Boiler, outside diameter barrel	74 in.	76 in.	72 in.	.....	78 in.	80 in.
Firebox, length	11 ft. 7/16 in.	10 ft. 11 9/16 in.	10 ft. 8/16 in.	.....	10 ft. 4 in.	10 ft.
Tubes, number	281	354	332	369	376	355
Tubes, outside diameter	2¼ in.	2 in.	2¼ in.	2 in.	2¼ in.	2¼ in.



BOILER FOR 115-TON PITTSBURG CONSOLIDATION LOCOMOTIVE.

Largest diameter of barrel, 83⅛ inches. Thickness of barrel plates, ⅞ inch. Length of fire box, 10 feet; front depth, 76¾ inches.

In the accompanying table we give a comparison of some of the most notable of the recent big freight locomotives, from which it will be seen that the latest is considerably the largest of the big fellows. They are arranged in the order of their construction.

The tender is of the standard type and weighs, loaded, 52 tons, so that the weight of the engine and tender in working order is 167 tons. The total length over all of engine and tender is 63 feet 3½ inches. The center of the boil-

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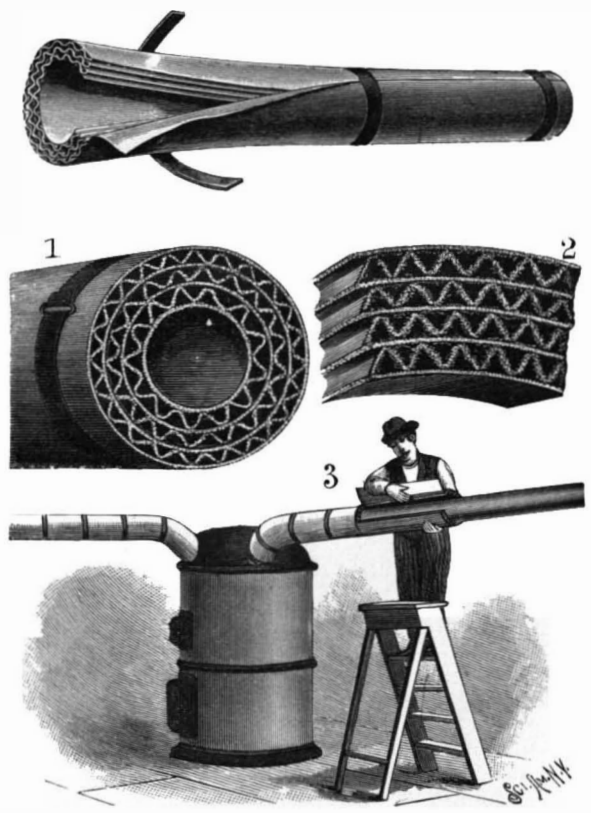
er is 9 feet 3⅜ inches above the rails, the top of the boiler is 13 feet and the smokestack 15½ feet above the rails. The driving axle journals are 9 by 12 inches, and the main crank-pin is 7 by 7 inches. The steam ports are 1⅜ inch wide by 20 inches long, while the exhaust ports are 3¼ inches by 20 inches. The tender has a capacity of 5,000 gallons of water and 10 tons of coal.

A NEW COVERING FOR BOILERS AND PIPES.

Where pipes are used for the conduction of steam heat, water, or heated air, considerable loss results



GAST'S ASBESTOS AIR-CELL COVERING.

from the radiation of the heat. This causes not only decreased efficiency of service, but increases the cost of the fuel.

To overcome and prevent this loss of heat, and thereby reduce the amount of fuel required, a covering known as "Gast's" Air-Cell Covering, manufactured by the New York Fireproof Covering Company, No. 23 Dey Street, New York, has been devised.

This covering, as is shown in Fig. 1, combines in its construction the well-known non conducting qualities of the "air-cell" structure and the fireproof characteristics of asbestos. The covering is composed of divided air-cells, each independent of the other, produced by arranging in alternate layers sheets of plain and corrugated asbestos paper, wound into cylinders of proper interior diameter to fit all standard sizes of pipes. These cylinders are split longitudinally, so that they can be readily slipped on the pipes. They are provided with an exterior canvas covering and with metal fastening bands.

The covering is neat, light, and easily applied, as well as non-conducting; it is fireproof (a feature that should receive consideration), will not harbor vermin, and will not decay or deteriorate with age. The covering is strongly and compactly made, and, owing to its peculiar construction, will not crack or powder from vibration of the pipes or hard usage. It may be removed and reapplied an indefinite number of times without loss or deterioration.

As indicated in Fig. 2, the covering is also made in blocks, slabs, and other special forms suitable for the non-conducting jackets for boilers, steam-drums, smoke-flues, breechings, hot air ducts, etc., and when so used is superior to ordinary cement, not only as a non-conductor, but as a preventive of rust.

The covering, on account of its fireproof and non-conducting qualities, is particularly serviceable for incasing the hot air pipes of the furnace heaters in the cellars of dwellings, etc. These pipes frequently lose in transmission more than half of heat generated in the furnace. This lost heat, when the pipes are covered by air-cell covering, would to a large extent be saved. The amount of fuel required would thus be reduced, and increased delivery of heat through registers would be attained.

A special form of this covering is also made for ammonia and brine pipes used in the manufacture of artificial ice and in the refrigeration of cold storage buildings. When applied to these pipes, the covering effectually prevents the formation of frost on the outside, thus increasing the efficiency. The covering may be employed in preventing cold water pipes from freezing and "sweating."

A New Hungarian Patent Publication.

As the Hungarian Patent Office does not publish any official gazette containing a record of the patents issued in that country, a journal has recently been established with a view to supplying this want. This journal is printed in four languages—Hungarian, German, French, and English. Some of the English descriptions are unique. We give below a specimen of the translations:

PROCEEDING AT THE PRODUCTION OF STOCKINGS OF THE LIGHT WITHOUT FLAME OF SPONTANEOUS IGNITION.

Claim.

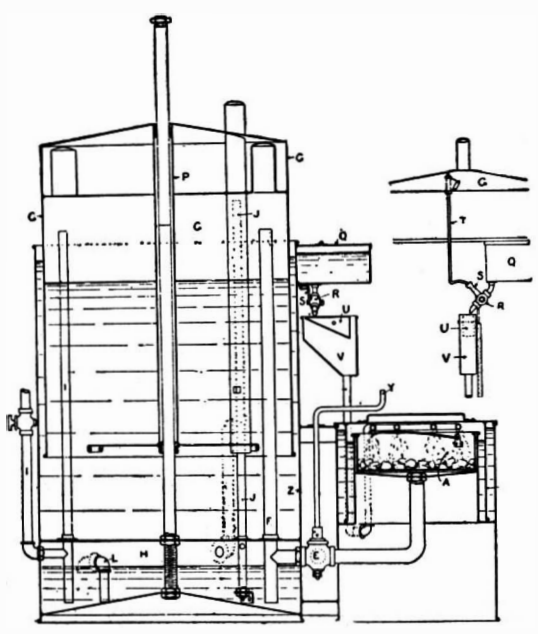
Proceeding at the production of stockings of the light without flame of spontaneous ignition without use of heaters or putting-in of lighters, characterized by a stocking of light without flame of a provenience whatever prepared in such a manner after it's treatement in an alcalic bath by impregnation of one portion of it's surface by platina—or iridium—salts, that these salts form ethiops of platina or iridium or the oxydes of incandescence—oxyde of thorium or cerium, etc.—causing the ignition of the stocking at the contact with the mixture of gas and air.

THE NATIONAL ACETYLENE GAS GENERATOR.

Not many years ago acetylene gas was merely a product of the chemical laboratory. Although the great light-value of acetylene was well known, the great cost of the gas prohibited its general introduction as an illuminant. Acetylene may now be said to have emerged from the experimental stage and entered into competition with other illuminants. Three years ago but little was known of automatic acetylene gas generators; now many manufacturers are actively engaged in selling their apparatus and perfecting the forms they have already devised. Among the manufacturers who early entered into the making of acetylene gas generators may be mentioned the National Acetylene Gas Company, of Cleveland, Ohio. The apparatus made by the company is distinguished by its automatic action, by the means provided whereby the gas may be readily controlled, and by the simplicity of construction and of operation.

The National acetylene generator, as shown in our cut and diagrams, embodies essentially a water supply, *Q*; a generator containing a carbid receptacle, *A*; and a gasometer or gasholder, *G*. The gas generated in the chamber, *A*, is conducted downwardly by means of a pipe, and, passing through the triple valve, *E*, controlled by the handle, *Y*, is discharged into the gasholder, *G*. Water is supplied from the tank, *Q*, to the carbid receptacle, *A*, by means of a pipe controlled by the valve, *R*, operated by the lever, *S*, through the medium of the rod, *T*, attached to the gasholder, *G*. In its course from the tank, *Q*, the water enters a tipping bucket, *U*, is discharged into the chamber, *V*, and, after having been conducted to the receptacle, *A*, is sprayed over the calcium carbid. The gas generated by the action of the water on the carbid, after filling the gasholder, is distributed by means of the pipe, *I*. As the pressure of the gas increases, the gasometer rises, and having reached a predetermined height, causes the rod, *T*, automatically to close the valve, *R*, in order to shut off the water from the carbid. When the gasometer descends, the valve is reopened and gas is again generated. Should the pressure become abnormally excessive, the surplus gas is discharged to the open air through the vent pipe, *J*.

THE NATIONAL ACETYLENE GAS GENERATOR.



SECTION OF GENERATOR AND DETAIL OF THE WATER-SUPPLY.

A SAFETY-ATTACHMENT FOR SCAFFOLDS.

Swinging scaffolds which are used in painting the outer faces of buildings are generally suspended from ropes passing through blocks. The ropes may break or become detached, and thus cause the scaffold to fall. To prevent such accidents, the safety attachment shown in the annexed illustration has been devised.

To some portion of the building above the highest point reached by the scaffold a device is secured to which a rope is attached. This device consists of a turnbuckle provided with rods extending far enough from each side to engage the inner faces of a window opening. A rope is secured to the turnbuckle by means of a hook, and is carried down around the scaffold and extended up beyond the other side, thus forming a loop in which the scaffold is inclosed. After having been passed around the scaffold, the rope is secured to a second turnbuckle by means of a hook adapted to slide on the rope and temporarily secured at any point by tying a knot in the rope. The second or lower turnbuckle can be moved up or down on the

CODY'S SAFETY-ATTACHMENT FOR SCAFFOLDS.

wall of the building, and is always held a short distance above the scaffold.

The first or upper turnbuckle is firmly secured to the upper part of the building and is left there until the work is completed. That portion of the rope which is secured to the upper turnbuckle is passed behind the lower turnbuckle, and thus serves to hold the scaffold against the building. The lower portion of the rope should be of such length as to reach the ground.

The safety rope encircles the scaffold with a slight slack, so that it may receive the weight of the scaffold, should the suspending ropes part or become detached from their support.

The attachment is the invention of Martin Cody, 106 East 109th Street, New York city.

AT the Colonial and Indian Exhibition, a few years ago, specimens of a whitish resin, bearing some resemblance to Manila elemi in appearance, were shown from the West Indies, and labeled "Gommier or Incense." These products are now referred to several trees of the natural order Burseraceæ. The Gommier or mountain Gommier, or Gommier rouge of Dominica and the Gommier à Canots of St. Lucia, appear to be Dacryodes hexandra, Griseb. Another species yielding a similar resin is Bursera gummifera, the birch tree of Jamacia, the Gommier of the Windward and Leeward Islands, and the turpentine tree of St. Vincent. The resin of Protium guineense affords the Gommier à l'encens of St. Lucia, the Tacamahaque huilense inicolore, the encens of Cayenne, and the Tacamahacca of Venezuela.—Kew Bulletin.

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THE ROTARY NEOSTYLE.

Some months ago we illustrated in these columns the Automatic Neostyle, a duplicating machine with which anyone could take a large number of copies from an original writing, drawing or typewriting by operating a lever. The Automatic Neostyle worked on the principle of a lever printing press.

The Neostyle Company, 96 Church Street, New York city, however, have now advanced one step further, and have recently placed on the market a duplicating apparatus known as the Rotary Neostyle, which operates on the principle of a cylinder press, and this machine is as far ahead of the old style duplicating machines as the latest Hoe cylinder presses are ahead of the old foot or lever presses.

The Rotary Neostyle is operated either by crank, treadle, or electricity. Fig. 1 shows the machine operated by crank. The stencil is laid on the outer surface of a drum made of perforated steel. The drum is rotated by an easy movement of the crank, the motion being imparted to the cylinder by means of gearing. As the cylinder is caused to rotate, an India rubber roller automatically rises at the proper moment, applies the necessary even pressure, forces the paper on which it is desired to print against the stencil, ink being forced through the stencil by means of a fountain ink roller on the inside of the cylinder. Operating the crank, therefore, causes the stencil to revolve, the necessary pressure to be applied, and copy to be automatically discharged. Very rapid and perfect work can be accomplished, as the operator has nothing to do but operate the crank with one hand and feed the machine with the other.

The machine illustrated in Fig. 2 is practically the same machine, but, instead of imparting movement by means of the crank, an electric motor is applied. This motor can be connected with any ordinary lamp socket, and an idea of the power required may be gained when it is stated that an ordinary ⅛ horse power fan motor is all that is necessary. A rheostat is provided which enables the operator to regulate the speed to suit his requirements, that is to say, a beginner can set the rheostat so as to print say 30 copies per minute, and, the operator having both hands free, a beginner can print easily at this speed. The maximum speed is about 70 copies per minute, and we are informed that in many railroad offices the machine is being operated daily at this speed. When it is remembered that this means a speed at the rate of over 4,000 copies per hour and that this speed is only equaled by the very expensive newspaper presses, it will be seen that, on the question of speed, there is very little room for improvement.

The work produced, whether autographic or typewritten, is such a close resemblance to actual original work that the Post Office authorities recently made a ruling that circulars duplicated by this process must pay letter postage rates, as they were indistinguishable from personal communications. The Neostyle Company have just succeeded in getting a modification of this ruling; so that all such work will go at third class rates, provided they be handed in at the post office windows in lots of 20 copies, and further giving the right of the sender to fill in the name and address and sign his name.

The Neostyle Company also furnish a patented envelope which, while apparently sealed, is in reality open, and this envelope has been accepted by the Post Office Department for mailing third class matter such as Neostyle circulars.

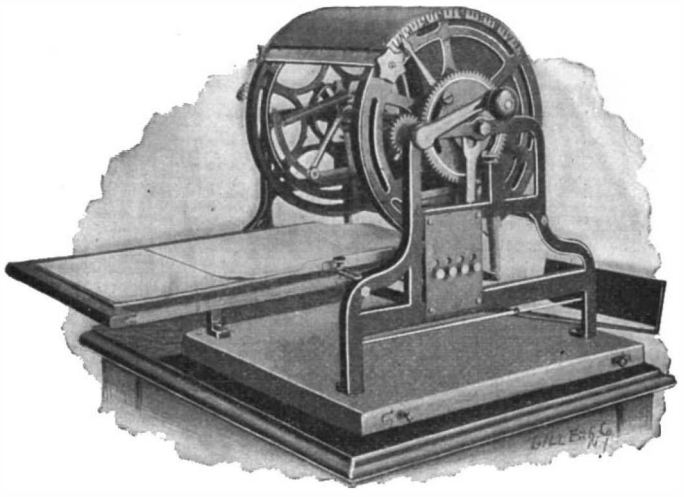

Fig. 1.—THE ROTARY NEOSTYLE.

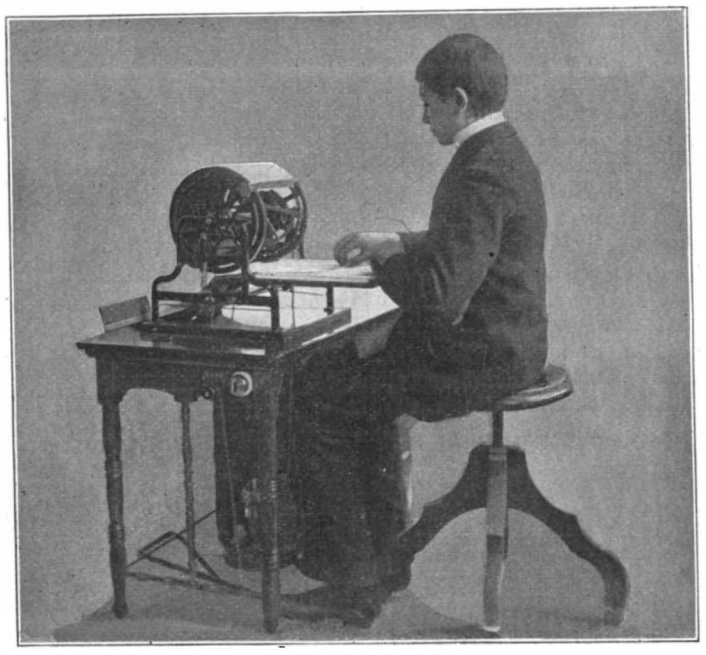

Fig. 2.—ELECTRICALLY DRIVEN NEOSTYLE.

Malaria Suppressed by the Use of Lime.

The following interesting letter from the pen of Mr. Minor C. Smith, of Norristown, Pa., was recently received, with the request that we should pass an opinion upon the theory advanced therein. The letter is as follows:

There can be no reasonable doubt that scores and hundreds of our younger men, especially those commanding large amounts of money, will in the near future turn their steps toward Cuba.

The fertile lands, bringing forth rich and valuable products, one crop following another in rapid succession, a soil 12 to 15 feet in depth, and rich to the core and through its entire depth, where it seems quite possible to grow about everything producible in a hot climate, needing nothing save the brain and brawn of American manhood to sow and reap. Then, too, the extensive forests, yet untouched, abounding in the richest and most choice woods, such as red cedars, mahogany, rosewood, ceiba, and ebony, will also be a great incentive to draw enterprising men toward Cuba. There we have also mines of untold richness abounding in various minerals, always a source of wealth when properly worked.

The above synopsis gives but a passing glance at Cuba's real wealth, but enough is definitely known to make that land a veritable Mecca for our people later on. There is, strictly speaking, but one serious drawback touching our colonization of these lands, and that is the exceedingly dangerous climate for others than immunes. As these are found only in our Southland, it practically blocks Northern and Western enterprise, and to seek for the possible solution of making Cuba a healthful, charming country for all classes of Americans will be indeed a delightful task. I say delightful, because I believe it can be done, and will be.

The writer was born and spent many years in the southwestern part of the Delaware and Maryland peninsula. Thirty-five years ago chills and fever, and the various forms of malarial infections, were as common in that otherwise delightful climate as "coffee for breakfast." The medical fraternity poured quinine and other febrifuges down the throats of their unfortunate patients by the boxful; but the infection raged the more. Finally, a gentleman came into the community and purchased a farm that the neighbors said was too poor to grow sandsnipes. Now, this man did not come to rid the community of chills and fever, but he invested his money, hoping to make a farm that would be the pride of the community and make eventually a good return for his original investment.

On one portion of this farm was a meadow land, filled with black snakes, mud turtles, bull frogs, and the other fellows who keep company with the above named crowd, and the mornings and evenings of each day saw rise above the meadow land a veritable cloud of miasma. No more unhealthy spot could be found for miles, and the farmer soon fell sick with fever, to keep company with the neighbors round about.

The important part of this communication begins just here. The farmer, without thought of breaking up the fevers or driving away forever the deadly miasmas that floated about that big meadow, began to haul quicklime by the carload, and in the early fall that meadow looked like a snow field in January. This done, the lime was applied to the entire farm, whereon fall grains were to be sown. Now, with the biggest subsoil plow ever seen in the community the progressive farmer turned under the sod to the depth of about two feet or more, and thus it lay for months.

The early spring of the next year saw a splendid new crop of timothy growing on this pest spot, and from that time on these lands, meadows and highlands, received their annual coating of lime and plaster; and in ten years, yes in five years, that was the finest farm in the whole section, and no chills or fever any more. In ten years the entire community was free from this awful pest through the widespread use of lime and plaster, and only a few days ago I heard from one of the leading citizens of the section referred to, and he was commenting on this very subject.

Now, Mr. Editor, if any of your readers know anything as to the value of calcareous land dressing along the lines referred to, let's hear from them. As to whether Cuba can be redeemed by such methods, aided, of course, by systematic drainage and more rigid sanitary rules, is indeed a very important question. One thing is very sure. It would cost this government but a trifle to make some experiments, and thus learn once for all whether such methods mean much or little or mean nothing at all. A few ship loads of lime and plaster generously spread on a reasonable portion of the island with proper drainage added would not be an expensive experiment and might suffice to solve the important problem. Very truly,

MINOR C. SMITH.

We submitted the question put forward by Mr. Smith to the Department of Agriculture, and we received in reply the following letter:

To the Editor of the SCIENTIFIC AMERICAN:

DEAR SIR: I have your request of October 29, to express my opinion on the correctness of a statement in a newspaper article, that the application of lime to a region which was infected with malaria purified it completely, and to state whether I think that the liberal use of lime in infected parts of Cuba would have the same effect upon the malarial germs in that locality.

In the first place, permit me to say that the evidence of an observer in a matter of this kind is very apt to be unreliable. People who observe phenomena of any kind, without a scientific study, are apt to jump at conclusions and to assume as the efficient cause in particular affairs the first cause which may be evident.

In regard to the action of lime upon malaria, I do not know that any definite information can be given. In general, however, it may be said that this much is known. Lime promotes vigorously the decay of organic matter, chiefly by furnishing a neutral or alkaline environment in which the nitrifying germs which are most active in the destruction of organic matter exercise their most important functions. The nitrifying germs are, in many respects, the most vigorous of all which are active in the decay of organic materials. If malaria be a germ which exhibits its highest vitality in an environment of organic matter and a genial warmth, it is evident that its vitality may be greatly diminished or entirely destroyed by the action of lime in promoting the growth of the nitrifying organisms. These organisms destroy organic matter very rapidly, and thus the source of nourishment of the malarial germs might be entirely cut off.

Last summer, near Berlin, I visited an establishment for purifying water, in which the nitrifying germs alone were employed as a purifying material. Sewage water from the city of Berlin, subjected to the action of these nitrifying organisms, was changed in two hours time to a clear, limpid water without any odor or apparent taint of organic matter, and in which there was not enough organic material for pathogenic germs to flourish with vigor. The nitrifying organisms in their vital functions not only destroy ordinary organic matter, but may even attack other organisms and destroy their vitality.

I think, therefore, that the liberal application of lime to all centers of infection would prove of immense benefit by promoting the vigorous development of nitrifying organisms, thus securing a rapid destruction of organic matter and the conversion of the nitrogenous part thereof into nitric acid or nitrates. Thus, indirectly lime might prove very valuable in disinfecting and destroying the germs of malaria in general and yellow fever in particular. I can express no opinion in regard to the amount of lime which would be required to disinfect the island of Cuba, but it probably would be so enormous that the application of it would have to be confined to localities where the greatest infection existed. I am, respectfully,

H. W. WILEY,
Chief of Chemical Division.

IT appears from The Engineering News that stones or pebbles, when in close proximity to metal pipes which have been subjected to electrolytic action, are electro-plated with the metal of the pipe, whether lead or iron. The following are some interesting remarks, on the subject, taken from a report of Mr. E. E. Brownell, of Dayton, O. He states that wherever any electrolytic action has attacked the cast-iron mains, there remains upon or adjacent to the mains a black substance that is due to the nascent oxygen being liberated from the decomposed water oxidizing the iron in the pipes, and this iron is then carried or held in solution by a solvent which is formed by the reaction of a current of electricity upon the constituents of the soil; from this solvent, the iron, lead, or whatever metal it has attacked, is taken or given up, to be deposited or electro-plated upon the soil and stones to the distance of several inches.

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Correspondence.

A Mechanical Imitation of the Human Voice.

To the Editor of the SCIENTIFIC AMERICAN:

Prof. Tyndall, in his work on "Sound," describes various methods of imitating the human voice by mechanical devices. The most successful seemed to be to stretch a piece of sheet rubber, in which was small slit, over the end of a glass tube, and to blow in the other end. I have found that this experiment may be successfully performed by stretching the rubber over the open top of a receiver from which the air is being exhausted by a Bunsen Sprengel pump. As the rubber is stretched and the edges of the slit approach and recede from each other, a decided change in pitch is noted, while the continuous action of the pump permits the experiment to be carried on indefinitely, and adapts it to class room demonstrations.

JAMES S. STEVENS, Prof. of Physics.
The University of Maine, Orono, Me.

Phosphorescence Caused by Decay.

To the Editor of the SCIENTIFIC AMERICAN:

Kindly explain me the following: One night, about 10 o'clock, having occasion to look in the pantry, I saw what afterward proved to be a common piece of pork steak emitting a phosphorescent gleam, not unlike that produced by the striking of matches upon a damp surface. Hardly crediting my eyes, I struck a match (at the light of which the gleam disappeared, of course), examined the meat, and found it had the slightest odor of putrefaction, but not enough to make it uneatable, I thought.

Blowing the match out, I again examined it in the dark, and found that the gleam did not appear on the bony surface of the meat. It is needless to add that I did not eat it. H. P. P.

[This is not an uncommon phenomenon. At certain stages of decay, both animal and vegetable substances are phosphorescent. The writer remembers, many years ago, seeing a log on a distant hillside which shone at night for an entire winter. It is very often seen in meat as in the case cited above. It is not well to eat food which has reached this stage of decay.

The cause of the phosphorescence is not fully understood. It is probably due to the chemical changes concerned in putrefaction.—EDS.]

Air Expansion Caused by Lightning.

To the Editor of the SCIENTIFIC AMERICAN:

During a severe thunderstorm, the lightning struck a barn not far from the house where I stopped, without setting it on fire. I ran to the barn, which was filled with smoke smelling much like sulphur. Two horses standing in the barn were completely deafened (probably by the report), but since have recovered their hearing.

In the loft huge slivers were torn from the posts on all four sides, and from the rafters also, in places, where it had apparently made its way downstairs and to the ground. One side of the barn was warped outwardly; a window in that side was demolished, but no glass could be found inside, all seeming to have been blown out. It looked as though an explosion had occurred inside of the barn, the outside damage being small. Only a few clapboards and shingles were knocked off.

On examining what I had before considered to be lightning conductors, I was surprised to find them mere dummies, having no electrical connection with the ground. There were two rods, one on each end of the barn, extending about four feet into the air, each upheld by four legs screwed into the shingles of the roof.

On reading up the subject of lightning rods, I find their object is to carry off to the ground the surplus electricity in the air, thereby preventing a discharge taking place in that vicinity, which gave me the idea that perhaps the mock lightning rods had conducted the electricity to their extreme limit, viz., the points of the screws passing through the shingles, thereby heavily charging the loft and causing a discharge to take place therein.

Please inform me whether my theory is at all probable. H. D.

[The lightning rods were surely in this case worse than none at all, and doubtless served as a path for the discharge into the building. When the electric discharge passed into the barn, it so heated and expanded the air as to blow the windows out and bulge the side walls. The lightning did not do this directly.

A lightning rod has two objects: one, to discharge electricity up from the earth into the air as the cloud approaches and so prevent the stroke, if possible; the other to serve as a path of discharge to the earth from the cloud. For both purposes the rod must extend down into the earth and into wet earth.—ED.]

ONLY seventy years have elapsed since the first railway in the world was finished. During that comparatively brief period 400,000 miles have been constructed, the British empire accounting for about a sixth.

Science Notes.

Our esteemed English contemporary Natural Science will cease publication at the close of the present year. All who are fond of natural history will be sorry to learn this interesting scientific journal cannot be maintained. The cessation of the present journal could be prevented if some one with sufficient time and means would come forward and assume the responsibilities of the present editor, who announces all the stock, appurtenances, and goodwill will be handed over to any scientific man who is prepared to take the responsibility and continue the journal.

Corundum is composed of the oxide of aluminum (Al_2O_3), but traces of the oxides of other metals are generally present as coloring materials. As in the cases of other minerals of non-metallic luster, the color of corundum varies considerably. Sometimes the mineral is colorless or white, and at other times it is found possessing a blue, pink, red, brown, gray, or other color. The relative weight of corundum compared with equal volumes of many other minerals is high. It has a specific gravity of about 4. while feldspar has a specific gravity of from 2·4 to 2·7 and quartz of 2·5 to 2·8.

Particulars concerning the expedition which will leave England in the course of the next few days for the purpose of visiting the almost unexplored island of Sokotra, situated about 150 miles east-northeast of Cape Guardafui, were given recently in The London Times. The party will consist of Mr. W. R. Ogilvie Grant, of the department of zoology in the British Museum; Dr. H. O. Forbes, the director of the Liverpool Museums; and Mr. Cutmore, taxidermist attached to the latter institution. The Royal Society, the Royal Geographical Society, and the British Association have provided part of the funds for the undertaking. The expedition will sail for Aden, proceeding thence to Sokotra by the Indian Marine guardship "Elphinstone," which, in compliance with a request made by the authorities of the British Museum, has been kindly placed at the disposal of Mr. Grant and Dr. Forbes for the purpose of conveying them to the island and back to Aden on the termination of their stay. The main object of the expedition is to investigate thoroughly the fauna of the place and make large and complete collections in every branch of zoology.

The New York Board of Health has approved of the recommendations suggested by Dr. Biggs, the bacteriologist to the board, that it should make to the Board of Education. Among these are the following: 1. The use of slates, slate pencils, and sponges shall be discontinued in all the public schools. 2. According to requirement, pupils shall be supplied with pencils and penholders, each pupil to retain those received in a box provided for the purpose, such box to be marked with the pupil's name. Pencils and penholders shall not be transferred from one pupil to another without suitable disinfection. 3. All school property left in the school building by a child suffering from any contagious disease, and all such property found in a room occupied by a family in which a case of infectious disease has occurred, shall be taken by the Health Department for disinfection or destruction. 4. Books which are taken home by pupils shall be covered regularly each month with brown manila paper. These regulations would appear to be somewhat stringent in character, but there is no doubt that scope exists for more precautions than are at present taken in our board schools. Notification has done much to minimize the spread of infectious disease, but it is attention to details such as the foregoing that will eventually stamp it out.—The Sanitarian.

Recently there was a "private view" at the Botanical Garden, Edgbaston, of the installation of acetylene gas, which had been introduced into the houses for the purposes of a garden party given to the United Kingdom Band of Hope Conference, and also for the garden party given by the Health Committee to the Sanitary Congress. There was a large attendance of members of the Botanical and Horticultural Society and others, and the various demonstrations and explanations which were given were listened to with much interest. In the course of the evening the honorable secretary of the gardens, Prof. Hillhouse, took the opportunity of saying that in the interests of the society he had studied the light from two points of view—injury to plants from evolved gases and relations with color. He had gone through the houses with the utmost care, and had failed to see the smallest sign of any of those injurious effects which the combustion of coal-gas had upon plants, and in this conclusion the veteran curator of the gardens, Mr. Latham, entirely agreed. The second point for inquiry received an equally satisfactory answer. The most critical colors, so far as artificial illuminants were concerned, came out of the ordeal with success. The mixed shades of mauve and magenta, such as those of the bougainvillea, were, at least, as perfectly displayed as with the arc light, while the various shades of yellow, from pale to deepest chrome, which were possessed by such a flower as the allamanda, could hardly be more distinguishable in ordinary sunlight.

Miscellaneous Notes and Receipts.

Removing Mineral Oil or Wax Spots.—For removing these spots, which are very hard to eradicate, especially when they have penetrated deeply into the fiber, owing to ironing of the said bodies, aniline is recommended. This remedy is used in the following mixture: Aniline, 1 part; soap, 1 part; water, 19 parts.—Der Seifen Fabrikant.

New Embalming Process.—An essential advantage of this new embalming method lies in the use of non-poisonous substances. Moran, in Paris, employs a mixture of 40 grammes of saltpeter, 40 grammes of potassium carbonate, and 1 liter of glycerine, which he injects into the aorta in such a quantity that a slight swelling becomes perceptible on the surface of the body. The corpse of a child preserved in this manner is said to have remained perfectly intact after having been kept for two years.—Neueste Erfindungen und Erfahrungen.

Copper Resinate.—This is produced as follows, according to the Farben Zeitung: Dissolve 8·55 kilogrammes of ammonia soda (18 per cent) in 90 liters of water, and heat the whole to a boil. Now throw in gradually and in small quantities 45 kilogrammes of good resin, stir diligently, and allow to boil until the resin has completely dissolved and has transformed into resin soap. Next dissolve 23·4 kilogrammes of copper sulphate (blue vitriol) in 18 liters of boiling water, and pour the resin soap into it. The cupric resinate now separates as a thick mass, which floats on the liquid. Gather, press out in a cloth, and dry, whereupon the resinate will be ready for use.

Fast Printer's Ink.—For the production of printing ink fast to washing, take 5 parts of acetic acid and dissolve therein 1 part of lunar caustic. Stand away this solution for one day, and add 20 parts of copal varnish, to which a little lampblack is added. Since the brown shade of the lunar caustic coloring predominates after repeated washings, especially if the wash is exposed to the sun, it is advisable to give the print a greenish appearance by moistening it lightly with a few drops of water in which a little potassium iodide has been dissolved. This ink should be used as fresh as possible, and the lunar caustic dissolved in acetic acid and the copal varnish solution should, therefore, each be kept in a closed flask, from which the quantity necessary for the print is taken each time in the said proportion.—Papier Zeitung.

Japanese Alloys.—In Japan some specialties in metallic alloys are in use, on whose composition the following details are at hand: Shadke consists of copper with 1 to 10 per cent of gold. Articles made from this alloy are laid in a pickle of blue vitriol, alum, and verdigris, until they acquire a bluish-black color. Guishi-bu-ichi is an alloy of copper containing 30 to 50 per cent of silver. It possesses a peculiar gray shade. Mokume consists of several compositions. Thus, about thirty gold foils (genuine) are welded together with shadke, copper, silver, and gui-shi bu-ichi, and pierced. The pierced holes are, after firm hammering together of the plates, filled up with the above named pickle. The finest Japanese brass consists of 10 parts copper and 8 parts zinc, and is called "siachu." The bell-metal, "karakane," is composed of copper, 10 parts; tin, 10 parts; iron, 0·5 part; and zinc, 1·5 parts. The copper is first fused, then the remaining metals are added in rotation.—Journal der Goldschmiedekunst.

Diathermanity of Various Insulating Materials.—An interesting comparison of the insulating action of various materials has been instituted by Prof. Carpenter, says the Schweizerische Bau Zeitung. If the loss of heat of a non-inclosed pipe is taken at 1, the following rotation of figures is obtained for the effect of the insulating agents: Pale gray lead paint coat, 1·267; asphalt coat, 1·135; two layers of asbestos paper, 0·777; one layer of asbestos board, 0·594; four layers of asbestos board, 0·503; a wooden pipe, 0·320; magnesia, applied as paste, 0·224; slag wool, felty, 0·209; asbestos, mixed with felt, 0·208; slag wool, fibrous, 0·203; asbestos with sponge, 0·180; two layers of asbestos paper, 2·5 millimeters felt, 0·170. Consequently, the escape of heat seems to be increased by lead paints and asphalt paint. Remarkable is the slight increase in the imperviousness in using four layers of asbestos board, as compared with the results obtained by the use of only one layer.

AN improved form of hydrometer, by means of which the effect of capillarity is eliminated, is proposed by the Rev. H. O'Toole, of Blackrock College, writing in The Scientific Proceedings of the Royal Dublin Society. It is similar in principle to Nicholson's hydrometer, but, instead of one bulb, it has two connected by a narrow stem of the same material and sectional area as that which supports the weight. It is first loaded till the lower bulb is immersed and then loaded till both bulbs are immersed. The additional weights put in at the second observation represent exactly the weight of a quantity of liquid equal in volume to the upper bulb between the two points of immersion.

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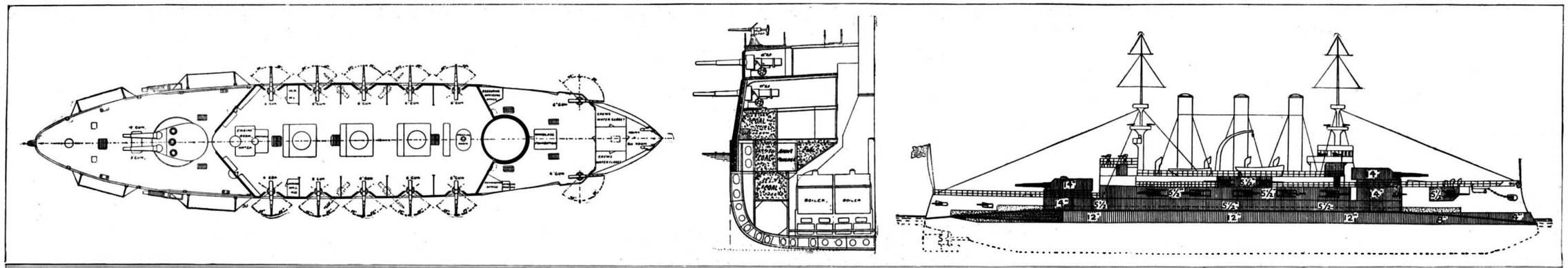

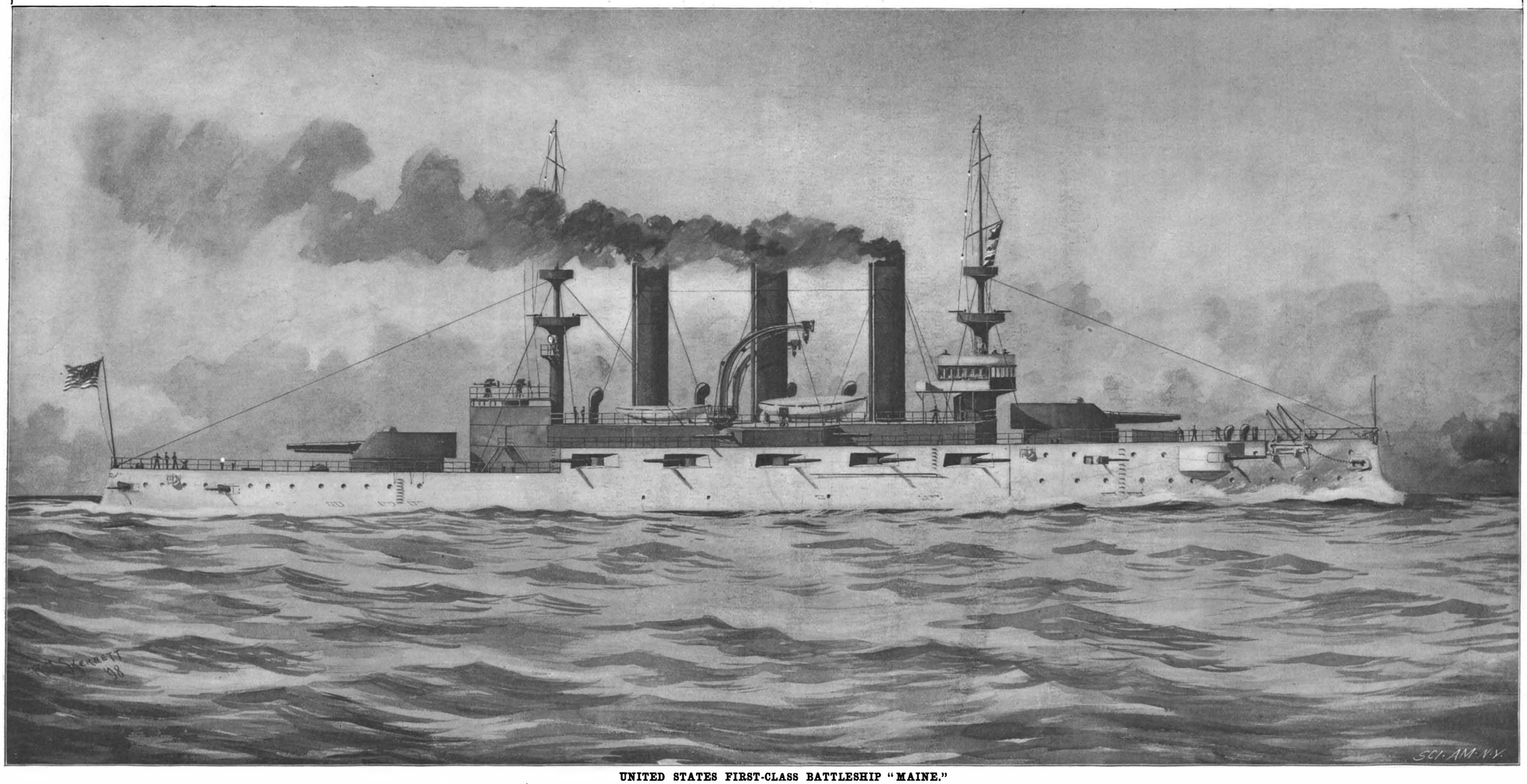

UNITED STATES FIRST-CLASS BATTLESHIP "MAINE."

Normal Displacement, 12,500 tons. **Speed,** 18 knots. **Bunker Capacity,** close stowage 2,000 tons. **Armor** (Krupp steel): Belt, 12 inches amidships to 4 inches at stern; barbettes, 14 inches; central battery and casemates, 5½ inches. **Armament,** four 12-inch guns (new pattern of high velocity), sixteen 6-inch rapid-fire, twenty 6-pounders, four 3-pounders, two smaller guns. **Torpedo Tubes,** two of submerged type. **Complement,** 600. **Authorized** 1898.

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THE FIRST-CLASS BATTLESHIP "MAINE."

On the accompanying page we present our readers with the first accurate engraving that has yet been made of the new battleship "Maine." The illustrations of this ship that have already appeared in several illustrated journals are based upon the original designs for an eighteen-knot vessel of inferior armament. The accompanying engraving is made from the latest amended designs, and includes the two additional 6-inch rapid-firers in the main deck battery, the substitution of two boat cranes for four, and other changes of a minor character.

In the three battleships of this type, the "Maine," "Ohio," and "Missouri," we shall have fighting ships at once the equals of anything abroad and reflecting credit upon our naval advancement. To the persistent stand of Engineer in-Chief Melville on the vital question of speed is the betterment of these ships over their predecessors, the "Illinois" and type, in the main due, and the increase of armament followed as a natural consequence upon the expansion of the original displacement of 11,525 tons.

The principal dimensions and general features are:

Length on load water line	388 ft 00 in.
Beam, extreme	72 " 2·5 "
Draught, at normal displacement	23 " 6 "
Displacement, normal	12,500 tons.
Indicated horse power	16,000
Speed, maximum	18 knots.
Coal bunker capacity	2,000 tons.
Complement, officers, seamen, and marines, about	600

The hulls of the ships are substantially similar to the "Illinois" type refined by the added length of twenty feet amidships. The inner bottom extends fore and aft throughout the major length of the vessels and reaches from the keel up to the lower edge of the armor belt, four feet below the normal load water line of 23 feet 6 inches. This double bottom space is divided into the usual watertight subdivisions and is under the reasonable control of powerful pumps. The interior of the vessels is also well cut up by the usual watertight subdivisioning, which is likewise under thorough pumpage and drainage control.

The ships have a freeboard forward of nineteen feet and a freeboard aft of eleven. The upper deck reaches from the stem aft to the after turret, and at the bow is flared out to a considerable extent. The main purpose is to make the ships drier in a head sea, but incidentally it affords ampler deck room for various purposes and more space on the deck beneath.

The details of the armor have not yet been finally determined, even though it has been decided that the armor shall be treated by the Krupp process, but there is every reason to believe it will remain practically as follows: The side waterline belt will be of armor having a maximum thickness of 12 inches for a depth of 4 feet, thence tapering to 8 inches at the armor shelf 3½ feet below. This maximum thickness will reach from a line nearly abreast the forward end of the after turret to a point just abreast the after end of the forward turret, and thence will taper to 4 inches at the stem. The protective deck will rest flatly on the inner ledge of this waterline belt throughout the engine, boiler and magazine spaces, and will be 2¾ inches thick, in two courses. Forward and aft of this region it will slope to the bow and to the stern. At the sides, aft, the deck will be 3 inches thick, amidships 1¾ inches thick, and forward the side slopes will be 2 inches thick, the armor of the waterline belt without making a greater thickness needless. The diagonal athwartship bulkheads at the extremities of the thickest part of the side armor will be 10 inches thick. The side armor above the armor belt and about the amidship battery of 6-inch guns will be of 5½ inches backed by two courses of half-inch hull plating. The casemate armor on the upper deck and the protection about the two 6-inch guns on the main deck way forward will also be of 5½-inch armor.

The turrets and barbettes will have a maximum thickness of 14 inches. The original design submitted contemplated a distribution and thickness of armor similar to that on the "Illinois" type, and the present reduction is due to the superior defensive qualities of the plating treated by the Krupp process. A very considerable reduction in weight is thus secured, and it is not yet certain that more widespread protection will not be given to the hull just above the waterline belt. A coffer dam about 36 inches wide extends forward and aft to the bow and to the stern from the athwartship armor bulkheads in the space between the protective and the berth decks. It will be filled with briquettes of corn-pith cellulose. On the berth deck there will be another coffer dam so filled and of like thickness. The efficacy of this cellulose belt has already been well established in actual conflict.

The ships will be propelled by two sets of triple expansion engines actuating twin screws. These engines will be put in separate watertight compartments. They will be of the three cylinder, vertical, inverted cylinder, direct-acting type, and the cylinders will be of 38½, 59, and 92 inches in diameter, with a common stroke of 42 inches. The high pressure cylinders will be forward and the low pressure cylinders aft. The collective indicated horse power of the propelling, air-pump and circulating pump engines will be 16,000 when the main engines are making in the neighborhood of 126 revolutions a minute.

Steam will be supplied by twenty-four boilers of the Niclausse water tube type, constructed for a working pressure of 250 pounds to the square inch, reduced to 200 pounds on the steam pipes at the high pressure cylinders. The boilers will be placed in four watertight compartments, and there will be four fire rooms, two double and two single. The boilers will be arranged in groups of eight. There will be three smokestacks, the tops of which will be practically 100 feet above the grate bars. Blowers will be fitted for forced draught.

The coal bunker capacity of 2,000 tons promises a very considerable radius of action in conjunction with the wholesale use of the more economical water tube boiler; and at a cruising speed of 10 knots the ships will have an exceptionally fine reach of action.

The armament will consist of four 12-inch breech-loading rifles, sixteen 6-inch rapid-fire rifles, twenty 6-pounder and four 3-pounder guns, and a couple of smaller pieces. The 12-inch guns, which will be of 40 calibers, will be of the new high powered type designed to use smokeless powder, and with a muzzle velocity of 3,000 feet per second, and firing an 850-pound shell, it will have the enormous energy of 48,000 foot tons, equal to the penetration of 4 feet of solid iron at the muzzle. There will be a considerable saving in weight. These guns will be mounted in two elliptical, balanced barbette turrets, and will have arcs of fire of 280 degrees. The sixteen 6-inch rapid-fire guns will be distributed four on the upper deck and twelve on the main deck. All will have wide arcs of fire, will carry heavy shields, and will be separated, one from the other, by splinter bulkheads 1¾ inches thick. Two of the 6-pounders will be mounted on the main deck just abaft the two bow 6-inch guns, four will be placed way aft on the berth deck, and the remaining ones up on the bridges and in the superstructure. The 3-pounders and the Gatlings will be mounted in the tops.

There will be two torpedo tubes of an under-water type, and they will be located where they will be practically beyond the ordinary reach of shot or shell.

The ammunition supply will be a large one.

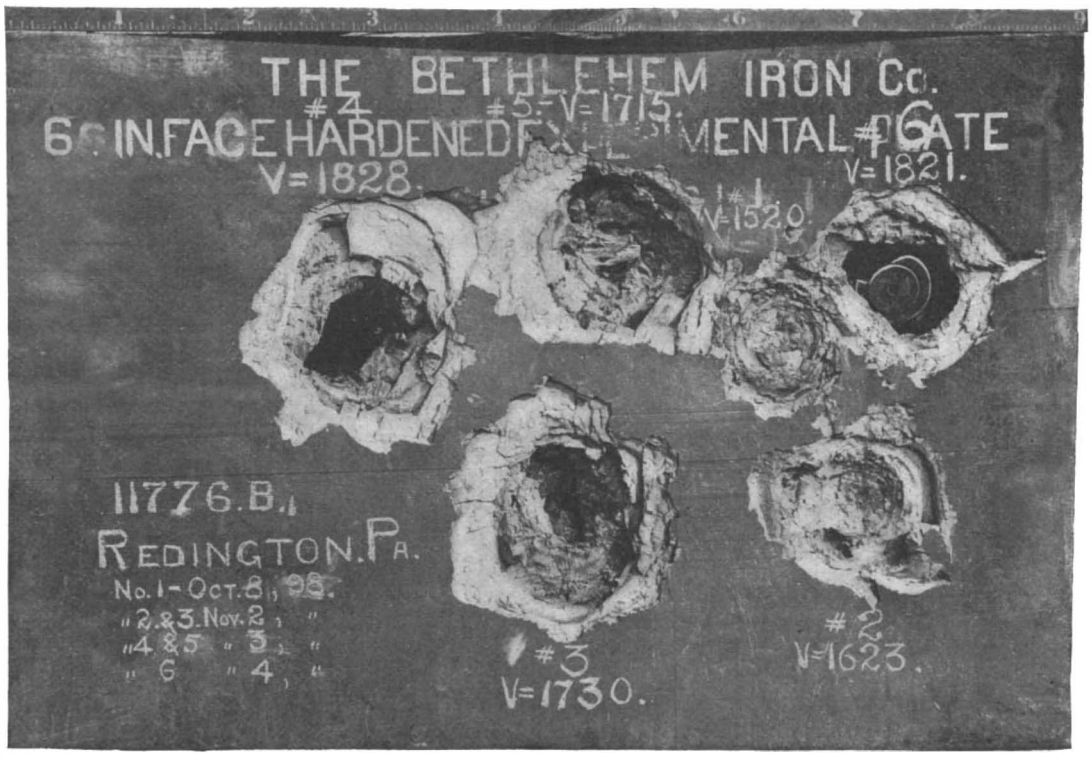
Electricity will constitute the motive energy for many of the auxiliary engines. It will run the ventilating blowers, it will hoist ammunition, turn and control the turrets, besides furnishing light within the craft and light without in the form of four searchlights and a double set of Ardois night signals.

There will be a dense air refrigerating plant with a daily output equivalent to the cooling qualities of two tons of ice. There will be a distilling plant, consisting of four evaporators and two distillers, with their accessories, having a combined capacity of 8,000 gallons of potable water daily.

Wood will be used but sparingly, and, with the exceptions of the main deck without the superstructure, the upper deck, and the bridges, the decks will be covered with linoleum, rubber tiling, wire mats, or cement. Such wood, other than decking, will be carefully fireproofed, but wherever possible, light metal work will supplant wood altogether, unless in the shape of gratings and such things easily removed and thrown overboard before going into action.

It has been suggested that a comparison of the British "Magnificent" with these new ships might be interesting. The "Magnificent" is of 14,900 tons displacement, and has a battery of four 12-inch, twelve 6-inch, eighteen 12-pounders, twelve 3-pounders, and eight machine guns. The weight of our four additional 6-inch guns is somewhat accounted for in the "Magnificent" in the extremely powerful force of 12 and 3-pounder guns and their ammunition, which is an item of moment. At the same time, the armament of the "Maine" is unquestionably the heavier. The waterline armor of the British ship is only 9 inches thick, but it reaches up the sides to a height of 18 feet, and extends fore and aft for a distance of 220 feet. The "Maine," however, has a decided advantage in the fact that the waterline belt is continuous up to the stem. The casemate armor about the 6-inch guns of the "Magnificent" is 6 inches thick. The protective deck is 2½ to 4 inches thick, the athwartship bulkheads are 14 inches thick, maximum. The conning tower is 14 inches thick, while the barbettes and barbette shields are 14 and 10 inches respectively. The coal supply is lighter by 156 tons, but the crew is composed of 757 persons, and the stores for the additional force are heavier. The ship makes about half a knot less speed than our ships, and, being a bulkier craft, to make that, her engines are heavier. Her boilers, too, of the Scotch type, are correspondingly weightier, and some of the structural accompaniments are of proportionate weight. The comparison shows how the most recent practices and our own system of hull protection yield certain savings of weight, which permit the weight of the defensive and offensive elements of the ship to be augmented to that extent.

The contract price for the "Maine" and her sister ships was $2,885,000, based upon the Cramps' bid.



TEST OF A BETHLEHEM, KRUPP-PROCESS ARMOR PLATE.

From photograph of plate after attack by six 8-inch armor-piercing projectiles. **Thickness of plate,** 6¼ inches. **Striking velocities,** 1,530, 1,623, 1,730, 1,715, 1,828, and 1,821 feet per second.

SUCCESSFUL TEST OF 6¼-INCH KRUPP PROCESS PLATE BY 8-INCH GUN.

BY LIEUT. G. L. CARDEN, ORDNANCE OFFICER, U. S. S. "MANNING."

A 6¼-inch Krupp process plate holds, to date, the armor record in the United States. In ordnance circles the plate is referred to as the "Champion." It was recently fabricated by the Bethlehem Iron Works, of South Bethlehem, Pa., and was tested during November on the Redington proving grounds.

The records show that the new plate has exceeded the requirements demanded of a 10-inch Harvey plate when attacked by an 8-inch gun. Six shots in all were fired at the Krupp plate, 8-inch armor-piercing projectiles being employed. The velocities recorded were 1,530, 1,623, 1,730, 1,715, 1,828, and 1,821 foot-seconds. The projectile fired at 1,828 foot-seconds velocity succeeded in partly getting through, while none of the others reached the backing. The 1,821 foot seconds shell was welded into the plate, but it did not succeed in piercing the target. The other projectiles were broken up on impact.

The Navy Department requirements, at present, for a standard 10-inch Harvey plate, when attacked by an 8-inch gun, call for two shots at 1,491 and 1,786 foot-seconds velocity. The 1,491 foot-seconds shell must neither crack nor perforate the plate, while that at 1,786 foot-seconds must not perforate, but may crack the plate.

The accompanying illustration shows the new plate

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after its final attack on the proving grounds. The absence of cracks is a noticeable feature in the result.

It is now learned on the best of authority that the specifications for the new battleships will call for Krupp process plates, with the usual proviso that the plates be fabricated in the United States. The superior resisting qualities of this armor will render it unnecessary in the future to place such massive plates upon the sides, barbettes and turrets of our battleships, and the modifying effect of the improved quality of armor is clearly shown in a comparison of the new battleship "Maine" with the "Oregon" and ships of her class. The superior quality of Krupp armor enables us to reduce the thickness of the belt from 18 inches in the "Oregon" to 12 inches in the "Maine," and a proportionate reduction is made in turret and barbette armor.

It is gratifying to realize that the latest product of our own armor-plate establishments is of such excellent quality as to maintain our high position in this industry.

The Cultivation of Walking Canes.

The fashion for congo canes has attained such gigantic proportions in the United States of late that some details regarding their manufacture and origin may not be without interest to the hundreds of thousands of men in America who use these popular walking sticks. Congo canes were first designed by a Frenchman, and the manufacture of the same was for a time confined wholly to France. They are made of the common overgrowth of wood that springs up from the stumps of ordinary chestnut trees soon after the trees have been felled. For a few years France did a thriving business in this new line of manufacture, the simplicity and handsome appearance of the canes winning rapid favor both at home and abroad. After a while, however, the trade reached such rapidly increasing dimensions that it attracted the attention of several large Austrian business men, who forthwith began to consider the feasibility of starting a competition in the same line, for in certain parts of Austria and Hungary, such as the provinces of Croatia and Krain, the growth of chestnut is enormous. They rented large tracts of land from the owners, agreeing to pay in return for the wood they should take away something like half a cent for every stick. Workingmen were easily obtained that would cut the sticks, working ten hours a day for the nominal wage of 80 kreuzers (32 cents) per day, so that the first steps in the cost of production were reduced to a minimum. The trade once started, good results were at once noticeable, and thus the industry which is to-day one of the most important in this monarchy was started.

The preliminary steps to be taken in the growth and manufacture of canes are very simple. In the early spring care must be taken to insure a good crop of sticks. Workmen are sent into the groves with nippers, and every stick that is to be cut later on must first be nipped. March is the best month for the nipping process, for in this month the shoots begin to sprout, and by the time autumn arrives they are ready to be gathered. Forestry laws here step in with restraining regulations by providing that a certain number of sticks in every grove must be left standing until they grow to a sufficient height to be used as telegraph poles. This does not take so long as one might think, however, for Austrian telegraph poles, it may be stated, resemble closely good-sized American bean poles, the wires being strung along the sides instead of on crossbars attached to the top of the poles.

The maximum length which the sticks reach in one season's growth—and if they are nipped in the spring the law specifically states that they must be gathered in the fall of the same year—is two meters; in thickness they vary all the way up to forty millimeters. Sticks which do not attain full growth by autumn must also be taken and be paid for at the regular price, but these are saved from waste by being bent and prepared to serve as umbrella handles. Thus every piece of material is utilized. When the entire crop has been gathered, the sticks are stripped of twigs and thrown into a bath of boiling water, which loosens the bark and makes the work of peeling quite easy. It is interesting to look on while the workmen deftly snatch the blistering hot sticks from the steaming pool and with bare hands draw the bark off in large pieces, as unconcernedly as any other person would handle the cane in a finished state.

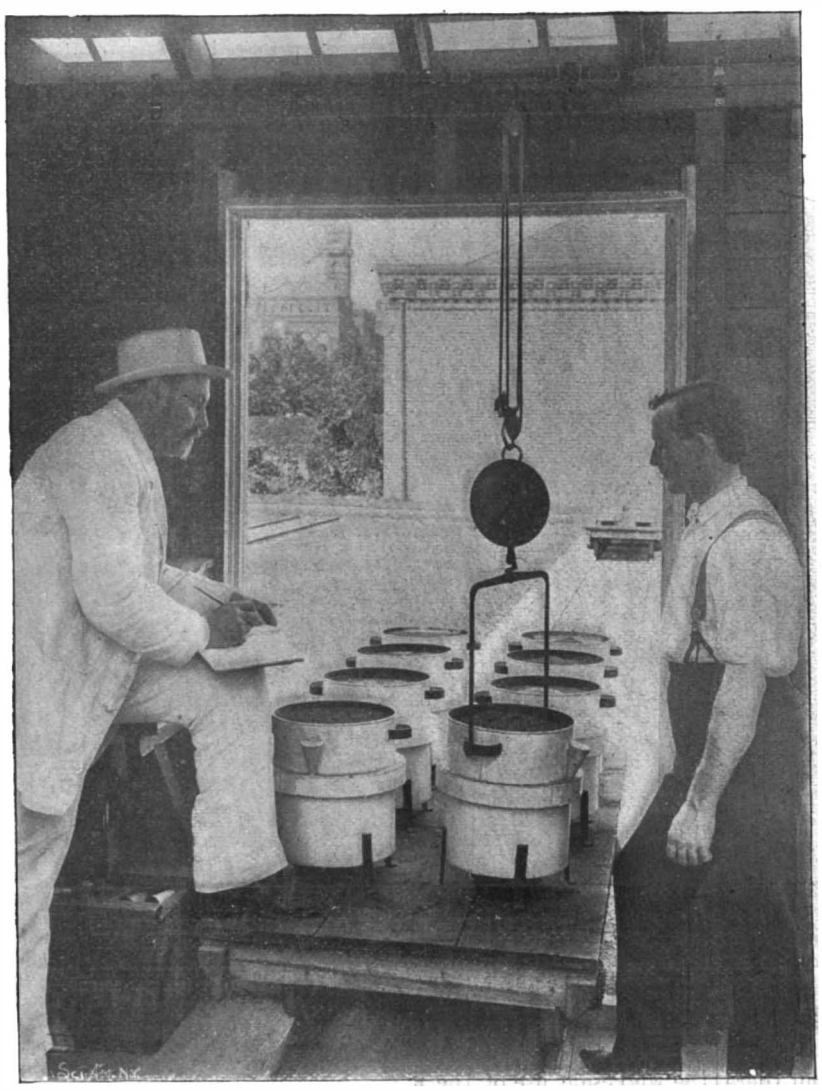
The industry of peeling and preparing the rough sticks for the future processes of bending, smoothing, and polishing is what is known here as a "Hausindustrie," a widespread and practical institution in Austria-Hungary. The "Hausindustrie" obtains in all branches of manufacture where the tools used are of the simplest and rudest kinds and the entire work may be done in the workingmen's homes. The advantage accruing to the laborer in thus accomplishing his work at home is great, for all the members of the family may take hold more or less and the small wage earned by the average "Tagelöhner" (day laborer) is increased twofold. In some parts of Germany, for example in the toy districts of Thüringen, the "Hausindustrie" has grown to so great an extent that many families have built up a large business, and their workshops are now more on the order of small factories. But the cane industry has by far not yet reached this point of development.

In order to take advantage of the clause in the present American tariff which places raw unmanufactured wood on the free list, all canes intended for shipment to the United States are sent over in the rough and finished by American buyers. It is estimated that from two to three millions of congo sticks are exported annually to the United States alone. England consumes a like amount, but the canes that go thither are exported in a finished state. The wholesale price of unfinished sticks in Austria is quite low, averaging from 14 to 17 kreuzers (5 to 7 cents) for the middle qualities and slightly more for the higher grades. These same canes, which are so inexpensive in Austria, when polished and fitted with silver tips and bands, retail in the United States for several dollars. As may be seen, the business is a paying one for the American retailer. Formerly, when the trade was in its infancy, land owners charged but a kreuzer per stick, and were glad to get rid of them at that price, but with the increased demand prices were raised, and now manufacturers cannot buy them for less than 3 kreuzers (1½ cents).

After the cane industry became firmly established and large tracts of land had been rented, fear became prevalent that the demand would not continue for a sufficient length of time to warrant large expenditures in developing the foreign market. This was the case with cherry wood several years ago, and cherry may now be purchased at prices that are considered next to nothing. But at present it appears that the market for chestnut will last for some years yet, unless a sudden change in fashion drives congo sticks out of use in the United States.

C. E. CARPENTER.

Vienna, Austria.



WEIGHING VEGETATION POTS.

THE rapid rise of the land about Hudson Bay is said to be the most remarktble gradual upheaval of an extensive region ever known. Driftwood-covered beaches are now 20 feet to 60 feet or 70 feet above the water, new islands have appeared, and many channels and all the old harbors have become too shallow for ships. At the present rate, the shallow bay will disappear in a few centuries, adding a vast area of dry land or salt marsh to British territory in America.

Thermophones.

The periodic changes of length or bulk produced by an oscillating current may be utilized for the electrical propagation of sound. The effect may be indefinitely increased by superimposing a steady current upon the variable current. A bolometer is inserted in the secondary circuit of a small induction coil. As long as the secondary current alone traverses the bolometer, no sound is heard. But as soon as an independent constant current is made to traverse the bolometer, every impulse of the induced current produces a noise in the bolometer, which in this case acts like a telephone. The loudness increases with the strength of the steady current. On replacing the induction coil by a microphone, nothing is heard. But even then, the sound may be brought out by Simon's sensitive arc. This is due to the strong steady current traversing the arc. If three or four secondary cells are put in circuit with a bolometer and a microphone, anything spoken into the latter is distinctly reproduced by the microphone. The bolometer may be replaced by strips of thin brass.—Braun in Annal. Phys. Chem.

THE STUDY OF TYPICAL SOILS.

BY MARCUS BENJAMIN, PH.D.

The Department of Agriculture in Washington has been wise in retaining during several successive administrations its able Chief of the Division of Chemistry. The result has been that during the years of his tenure of office, Dr. Harvey W. Wiley has been able to plan and complete several valuable series of experiments. None of these, perhaps, have occupied his closer interest and attention more than those which have had for their object the study of the growth of various plants under similar conditions but with varying soils. In fact, the investigation may be designated as a study of typical soils, and is perhaps the first attempt ever made in this country to study any number of soils under like conditions.

In a way the work is an extension of that most excellent series of studies that have been carried on at the celebrated Experiment Station in Rothamsted, England, under the direction of Sir John Henry Gilbert and Sir John Bennett Lawes, who for more than half a century have had charge of the scientific work in that place.

Typical soils from between thirty and forty places scattered throughout the United States were procured through the agencies of the Department of Agriculture, and a direct comparison was instituted with samples of soils of known constituents obtained from Rothamsted.

A plot of ground in the rear of the main building of the Agricultural Department was set aside for these experiments, which were begun in 1892, and a small green-house erected in which the plants are kept during the night and in rainy weather, but at other times they are rolled out into the air. This is easily accomplished, as the pots are all on trucks which may be moved at will along the tracks, as shown in illustrations.

For a portion of the season oats and beans were grown in duplicate samples of typical soils. After the crops from these plants had been harvested, the soil in the pots was again prepared for planting, and a crop of buckwheat grown. By this means two crops are secured during each season, so that the value of the experiment is largely increased, in consequence of duplicating the data obtained.

Very careful attention is naturally given to the water supplied to the pots, and formerly at proper intervals a known amount of distilled water was added to the soil by means of glass measuring vessels, but as the work has progressed, these have been discarded and a number of tin vessels, each holding two pounds of distilled water, have been substituted. As the amount of water added to every pot must be known (so that the conditions may be identical), this improved method makes it possible to add one portion of water to each of the pots in the course of two hours. This is accomplished by inserting the tin funnels containing water in the funnel holder on the side of the pot, as shown in the illustration.

Next perhaps in importance to the addition of water to the soil is the determination of the amount of moisture contained in the pot at any given period. For a long time this factor was determined chiefly by an inspection of the surface, with an occasional weighing of the pot. This method, while capable of yielding excellent results when under the immediate supervision of an expert, was frequently interrupted, owing to the absence of Dr. Wiley, who was liable to be called elsewhere by other duties. Accordingly it was deemed advantageous to have a more rigid control of the quantity of moisture present. Consequently, weekly weighings of the pots are now made, so that the quantity of moisture which has been evaporated

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during the seven days may be directly determined. Knowing the quantity necessary to produce complete saturation of the soil, a simple calculation will show the quantity to be added in order that the amount of moisture in the soil shall be between 60 and 70 per cent of the total quantity necessary for its complete saturation.

For a time the weighing of each individual pot not only consumed a large amount of time, but also proved a very arduous undertaking for the attendant in charge of the pots. Accordingly, the method of weighing was improved by an ingenious mechanical device which renders it possible for one person, without assistance and without undue physical exertion in the way of lifting the pots, to weigh the entire lot of 176 in about four hours. This is shown in one of the accompanying illustrations, which is also of special interest as showing Dr. Wiley himself in the act of writing down the weights.

The final illustration shows the screen or hood that has been devised for the purpose of protecting the plants from the action of the wind and from the attacks of birds.

The laboratory work includes determinations of the total amount of dry matter produced in each pot, together with the amounts of nitrogen, phosphoric acid, and potash removed from the soil by each crop. The data from seven seasons is now at hand, and the preparation of a preliminary report is under way. It will contain statements in regard to the composition of the soils, their physical character, their water-holding capacity, their contents of humus, and the percentage of nitrogen, phosphoric acid, and potash contained therein, both as regards total content and in respect of the quantities removed by different solvents. This report will be illustrated, not only by analytical tables, but also graphically in such a way as to show in the most evident manner the relation which exists between the physical and chemical composition of the soil, its contents of moisture, and the quantity of dry organic matter produced.

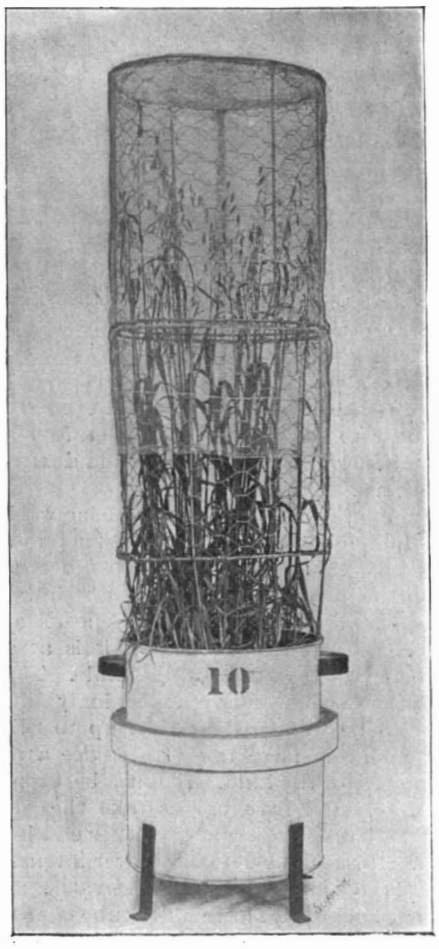
This is but one of several investigations now being conducted under the direction of the Chief of the Chemical Division of the Department of Agriculture. The great value to the farmer is obvious, for as a result of this investigation a chemical analysis of a given soil will at once determine what plant foods may be deficient in it for the production of a given crop and at the same time it will show the farmer how to supply these deficiencies when practicable by the judicious application of fertilizers or by a suitable rotation of crops. Thus in the end it will demonstrate what crops grown on a given soil will yield the greatest amount of profit to the farmer.

The slow and even tedious work necessary for the satisfactory completion of investigations carried on in the scientific bureaus of our government is not always appreciated by the general public, but when the results that are sure to ensue are so far-reaching in effects as those of the investigation which has just been so briefly outlined, then, indeed, does the wisdom of the work become clearly manifest.

THE committee on endowment of the Franklin Institute, Philadelphia, is making an appeal for subscriptions to the endowment fund. It is of the utmost importance for the future prosperity and progress of the Institute that a substantial addition to its annual revenues be acquired, not only to provide income sufficient to carry on its present work, but also to enable it to extend this in other directions.

Russian Foreign Trade.

The reports of the foreign trade of Russia last year show it to have been very satisfactory. The total exports amounted in value to $399,955,835, an increase of about 5 per cent on the previous year; and the imports to $377,641,045, a decrease of about the same amount for the same time. The increased value of the exports is attributed to the enhanced price of grain caused by the failure of the crops in India and elsewhere; in other things, such as flax and hemp, there was a very appreciable decline, and the petroleum trade fell off somewhat, owing to the competition of American oil. The home demand for oil, however, increased so that the producing industry did not suffer in any way. The exports of timber and wood products were very profitable, and the value of the eggs sent abroad amounted to nearly $15,000,000. There was also a considerable increase in the exports of cotton goods and iron ware of all kinds, principally to Asiatic countries, mostly to central Asia and Persia.



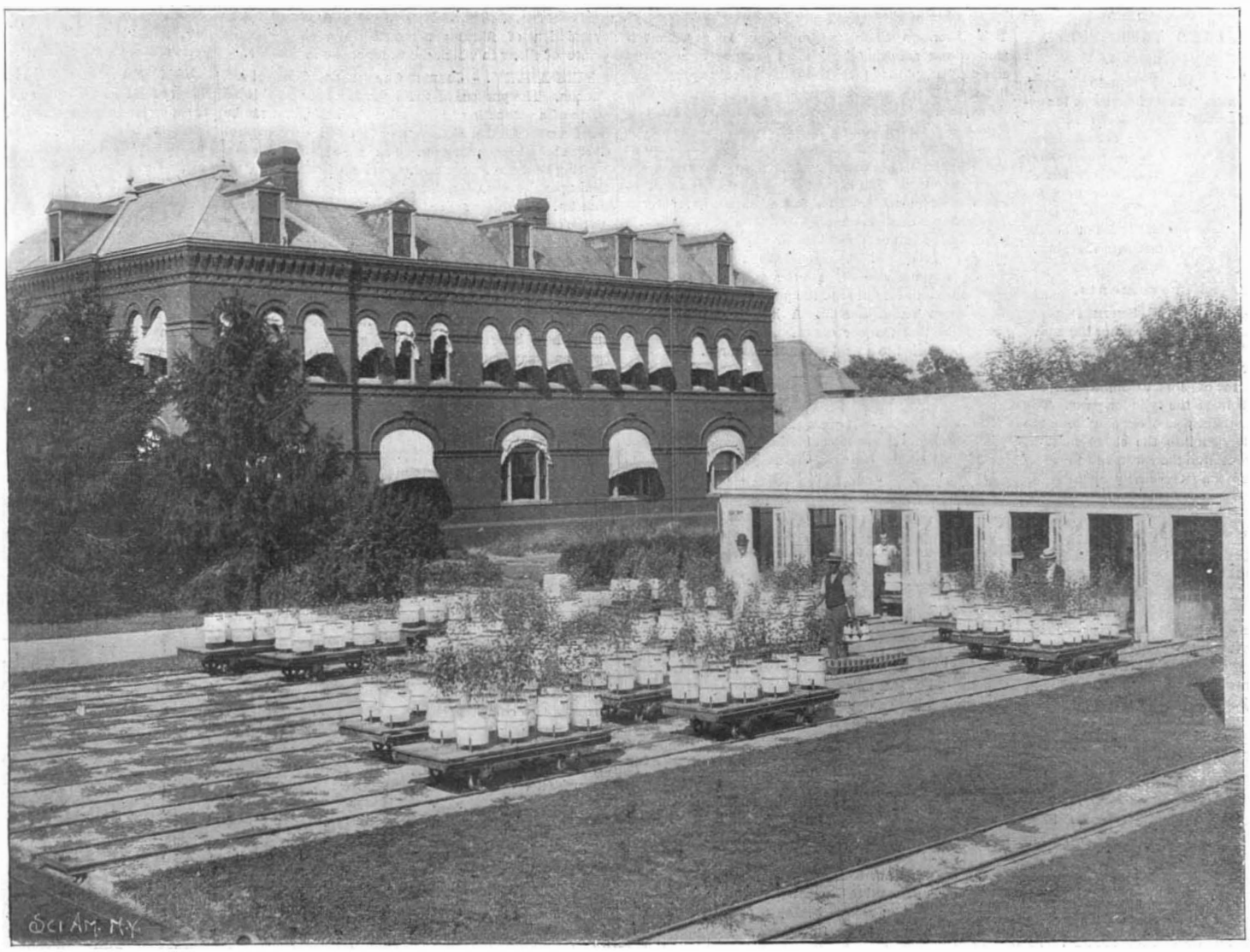
VEGETATION POT CONTAINING GROWING OATS.

As regards imports there was an increase in the manufactures of iron, and in raw materials, such as cotton, jute, and silk, the manufacturing of which is steadily increasing. The imports of tea decreased considerably, being probably displaced by beer, the brewing of which is becoming an important Russian industry. Of the total Russian foreign trade about 18·6 per cent is done with England, the remainder being largely with Germany, but a good proportion with the Mediterranean countries and France. With England the export trade last year declined and the imports only held their own.

A notable fact that has caused much comment in England was the purchase by the Finnish Railway Company of twenty powerful locomotives from American builders during the past year. The business of supplying these machines had previously been held by English builders. The British consular reports from Russia on the subject of British trade with that country attribute its want of development to the absence of activity on the part of British manufacturers and exporters, and to the slowness of the former in adapting their machinery to the production of goods suited to the taste and wants of the Russian markets. Apparently this leaves a good field open to American exporters to western territories of Russia, as well as to those developing in the East, with prospects of profitable results if they enter it in time and with goods to meet the requirements of the market.

The Trinidad Pitch Lake.

The famous pitch lake, or great bitumen deposit, of Trinidad is situated at Point Librea, on an elevation at about a mile from the sea. It covers an area, says Popular Science, of nearly one hundred acres, and its appearance is that of a dull, still, dark waste. It is irregularly circular, and its surface perceptibly convex, being more elevated in the center, and thence insensibly declining on all sides. In the center the pitch is quite soft, in fact, semi-liquid, but it becomes more and more hardened as its circumference widens out. Except the soft central parts, the surface is intersected in all directions by numerous fissures or chasms, varying in breadth from two feet to sixteen feet, and from half a foot to seven feet in depth, widening also at the surface, and terminating acutely at the bottom, thus producing, as it were, inverted angular hollows, while the sides are regularly rounded. These crevices are always filled with fresh water. Here and there where the bitumen is mixed with earthy matter grow lichens, mosses, grasses, etc. The center of the lake, the pitch pot, or chaudiere as it is called, is at all times so soft that it would be impossible to venture on it without incurring the danger of being engulfed. The lake is government property, and parts of it are leased out to private individuals, who have to pay royalties according to the amount of pitch removed, which amount is checked by the government. The lake is practically inexhaustible. No matter what quantity is taken out, it is replaced by fresh pitch, which always wells up to fill the whole. The surface of the outer edges of this most wonderful of lakes is quite hard enough to walk upon; but a curious result ensues if you stand still for any length of time on one spot. For some yards around you the pitch bodily sinks until it forms a sort of basin.



THE DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.—THE VEGETATION HOUSE AND CARS OF THE DIVISION OF CHEMISTRY FOR THE STUDY OF SOILS.

LONDON has one street 70 feet long, being the shortest street in the city.

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Automatic Feed for Water-tube Boilers.

BY EGBERT P. WATSON.

The small water content of water-tube boilers as compared with fire-tube boilers demands a regular and constant feed at all times and under all circumstances when the boiler is in action; otherwise the boiler is in danger of being burned. Even if it is not burned, the tubes are liable to pull out of the tube-sheet from being softened by overheating, and serious accidents have occurred from this cause, one but a very short time ago. Men who have had no training with water-tube boilers should not be put in charge of them. But a few weeks ago the writer had a young man in his service who was of more than average intelligence, and had had, as well, several weeks' training under him in the management of a water-tube boiler of high efficiency. This young man was left in charge of a boiler carrying 225 pounds of steam under forced draught, with positive injunctions not to leave the front of it or take his eyes off the water-gage for a moment. The writer was absent just ten minutes, and, on his return, heard the pop-valve going when he got within 200 feet of the boiler. Quickening his steps, he reached the boiler just in time to prevent its destruction by burning. The water had disappeared from the glass, but issued in fitful spits from the lowest gage cock, showing that it was still above the danger line. No one was about the boiler, but in a minute or two the young man before mentioned returned, and, upon being soundly rated for his recklessness, declared that he had only been absent a few minutes from necessity. The fire had burned up white hot in the few minutes he was away, and the water had gone out most rapidly, or more rapidly than the engine could use it. Had there been an automatic feed on the boiler, everything would have run quite smoothly.

The feed on the boiler alluded to was kept up by an injector, but it is usually maintained in this class of boilers by pumps, in default of anything better. It is, in any case, however, a constant source of danger, or rather anxiety, especially with marine boilers under severe duty. Upon torpedo boats and high speed yachts the boilers are worked far above their normal rating, and as there is but a small body of water in the boiler, even when at rest, the water level, when the boiler is driven by an air blast of five or six pounds pressure, is liable to sudden fluctuations, and has to be carefully watched. The feed must not cease for one moment while the boiler is in full work, and engineers are fully alive to the necessity of an automatic feed. To devise one that will fill all requirements is not so simple as might seem upon the face of it, and any one who undertakes the task with the idea that it is, and that some sort of a self-regulating valve, or other common device, will do the work, will be undeceived when his plans are put to the crucial test of actual running. An automatic feed for a marine water-tube boiler must have brains of its own, so to speak, and know when to put water in and when not to. Just how to accomplish this has puzzled the best engineers of the world, so far. There are some devices of the sort named in use to-day, but there are not many, and they have objections which render them anything but reliable under all circumstances. Too frequently, owing to their principle of action, they speedily work their own ruin. Some of them require as much supervision as a common pump, and therefore do not fulfill their mission. When all the water is going out and none coming in, or not enough to keep up with the evaporation, only two courses are possible: One is to get more water instantly from somewhere; the other, to stop the vessel and haul the fires. What this last operation involves is known only to those who have been compelled to do it. To suddenly deposit nearly half a ton of white-hot coal on the floor of a fire-room only a few feet square—the mere hauling of it, even—is a serious matter, only to be undertaken when it is a case of ruining a boiler or a matter of life and death to all in the vicinity.

An automatic feed device for marine work must be of the simplest construction and based upon well known laws. Small valve stems delicately balanced are highly objectionable, for the reason that, although they work well when new and smooth, the deposits and accretions from the water (especially if it is at all saline) soon render the apparatus unreliable. To cover all the conditions successfully is exceedingly difficult, and it is not to be wondered at that up to this present writing engineers have failed to devise a reasonably reliable device of the kind. It must be borne in mind that marine water-tube boilers take the water in at one end and discharge it at the other end in the form of steam. It is rapidly circulated over intensely heated surfaces in comparatively thin streams, and, there being no crown-sheet, as in a fire-tube boiler, there is no reserve water at all. The evaporation is so rapid that the entire contents of a water-tube boiler may be turned into steam in a very few minutes, if the feed is stopped. In a sixty-horse power water-tube boiler, for example, there is a total content of about 600 pounds of water. The heating surface would be about 500 square feet. Now, if the boiler evaporates only five pounds of water per square foot of heating surface per hour, it would only require a quarter of an hour to boil out every drop in it, and but a very few minutes to lower the water level to the danger point.

From these plain facts it is easy to see that an automatic feed is essential to the success of boilers of the type discussed, and equally apparent that the proposition is not a simple one. Danger signals, such as blowing whistles and displaying devices of one kind or another to show engineers that the water is low, would not be tolerated. There is a man constantly on watch for this very function, and he is apt to find it out long before a whistle would. What is required is a simple mechanism that will keep up the water supply as fast as it evaporates, and will stop acting when the boiler stops; for less than two minutes would flood the boiler if the feed kept working. The man who can devise such a machine will have work supplying the demand for a long time to come.

CHARLES A. SCHOTT, Chief of the Computation Division of the Coast and Geodetic Survey, has been awarded the Wilde Prize by the French Academy. The Wilde Prize is a coveted honor open to the world, to be conferred on the one judged the most worthy from among those who make discoveries or write works on astronomy, chemistry, geology, physics, or mechanics. The award to Mr. Schott is based on a work on terrestrial magnetism. The committee which made the award consisted of some of the best-known scientists in France, including MM. Savvan, Bertrand, Levy, and Berthelot.

The Current Supplement.

The current SUPPLEMENT, No. 1196, contains many interesting articles, notably one on "The Kaiser's Pilgrimage to the Holy Land," accompanied by views of vessels which accompanied the Emperor's yacht, views in Jerusalem, etc. "Torpedo Boat Destroyers" is an important paper read before the Society of Naval Architects by G. W. Dickie, and "Designs for New Vessels for the United States Navy" is by Philip Hichborn, chief constructor United States Navy. Both these papers are of great value. "Foods" is a lecture delivered before the Drexel Institute by Dr. A. P. Brubaker and has been revised for the SCIENTIFIC AMERICAN SUPPLEMENT.

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RECENTLY PATENTED INVENTIONS.

Electrical Appliances.

ELECTRIC ACCUMULATOR.—FEDERICO PESCETTO, Turin, Italy. The present invention seeks to provide improved means for manufacturing electric accumulator-plates. The plates are cast in the usual manner, and with the minium and with the litharge which serve to form the active material of the plates, ulmin "ulmate" is mixed. The inventor claims that a plate thus prepared is lighter in weight than most accumulator-plates, that the reacting surface is increased, and that the active material is readily held in contact with the plate.

Engineering Improvements.

ROTARY VALVE.—BRAINERD W. SMITH, Delphos, Ohio. The valve-mechanism of this inventor has a segmental valve-seat on which is mounted to turn a valve formed with a cavity for connecting the cylindrical ports with the valve-chest and the exhaust, to admit and exhaust the steam to and from the cylinder-ports. The valve is formed with an auxiliary port opening into the cavity, and is arranged to open into the steam-chest at the time the cavity opens into the chest, and to be cut off or closed during the time the cavity opens to the exhaust.

Mechanical Devices.

MACHINE FOR SCREWING UP OR UNSCREWING PIPES.—CHARLES H. MCCREADY, Neodesha, Kan. This machine, for turning pipes, screw-rods, and similar articles, comprises jaws adapted to grip the pipe; a ring on which the jaws are fulcrumed; a driven revoluble ring connected with the jaws, to close the latter on the pipe, and to carry around the jaws, together with the ring on which the jaws are fulcrumed, the connection between the driven ring and the jaws consisting of a pin mounted to turn on the ring; a clevis fulcrumed on the pin; and a link connecting the clevis with a clip on the jaw.

ADDING-MACHINE.—WILLIAM R. GILBERT, Binnsville, Miss. The machine devised by this inventor is inclosed in a casing in one end of which two independent reels are mounted to turn. On the periphery of a third reel, mounted in the opposite end of the casing, an annulus turns. Two numbered tapes are attached to the two first-named reels and wound respectively around the third reel and around the annulus. The third reel and the annulus have portions projecting without the casing to permit the third reel and the annulus to be turned. A stop-arm is rigidly held by the casing to indicate the limit of movement to which the third reel and annulus are to be turned. The numbered tapes having been thus set in motion, the total sum appears on the tapes at observation openings in the casing. After noting the sum observed, the operator returns the parts to their normal position by releasing the springs attached to the reels.

ORE REDUCING AND SEPARATING MECHANISM.—PHILIP J. LONERGAN, Colorado Springs, Col. This invention seeks to provide an improvement in pan-process amalgamators, in the nature of a "pan-arrastre" adapted to take the ore directly from the rock-breaker. The machine provided for this purpose is designed to work at its maximum energy, to keep the pulp thoroughly under control and in contact with the shoes until it is reduced to the proper fineness, and to separate and discharge automatically this pulp into a slime-receiver or gutter. The invention comprehends the construction of a machine of this kind, having its center or dead area eliminated, whereby the diameter of the pan is increased, and an enlarged annular way having a superficial area is produced. Thus are created a working channel for the pulp and shoes of a large capacity, adapted to give mechanical motion to the pulp over the whole area by a direct action thereon. A long detention of the pulp is in this manner obtained, enabling it to settle and to be carried to a final point of discharge.

Miscellaneous Inventions.

PIGEON-TRAP.—GEORGE S. MOTT, Babylon, N. Y. The trap forming the subject of this invention is a sporting trap having a setting-lever connected with a bird-cage to close the cage. Mechanism is connected with the lever, whereby the trap is opened when the lever is released. A triggers locks and releases the lever. A gearing driven from the lever actuates a disturbing device operating in conjunction with the cage, to frighten the bird on opening the cage.

BRUSH.—LYDA D. NEWMAN, New York city. To provide a hair-brush, so arranged as to be readily cleaned, this inventor forms recesses in the front face of the brush-back, the bristle-holder being set in the recess and partly filling it so as to leave an air-chamber in the rear of the holder. The holder, moreover, has slots extending through it from front to rear between the rows of bristles, the slots thus communicating with the air-chamber. Impurities from the scalp or hair can readily pass through the slots to the recess in the back, and can be easily removed.

DARK LANTERN.—ROSS M. G. PHILLIPS, Los Angeles, Cal. In this dark lantern are provided two pivoted slides for the lens and a locking device to connect the slides, whereby one slide may be opened independently of the other, or both may be opened together. One slide may be actuated to throw the light down, the other slide permitting the rays to be directed straight ahead.

FILTER.—JOHN H. SIEBER, Henderson, Ky. The filter forming the subject of the present invention comprises a casing in which a porous filtering stone and a cleaning stone, spring-pressed into engagement with the filtering stone, are inclosed. The water is first passed through the filtering stone and then into a service-pipe. The outer surface of the filtering stone may be cleaned when necessary by rotating it against the cleaning stone. The inlet for unfiltered water, lying directly over the filtering stone, causes water to be showered over the entire surface of the stone, thus preventing the large accumulation of filtrates necessarily deposited on the stones of filters in which the water enters at the side.

FIRE-ALARM.—JOSEPH CASAVELLO, Cumberland, Canada. The purpose of this invention is to provide an alarm of a detonating or explosive character, that can be heard a considerable distance and that will be comparatively cheap to manufacture. The fire-alarm comprises a casing having a screen wall, a series of canisters containing explosive material, and a fuse leading into each canister. The fuses are extended around the building. As the combustible material of the fuses becomes ignited, the canisters will, as a result, be exploded, not, however, with sufficient force to injure the building.

BINDER AND SHEET.—JOSEPH S. HAM, Portland, Me. One of the features of this invention lies in the provision of means whereby McGill fasteners may be firmly held between the two sides of the cover at the back, and may be readily replaced should they be damaged. A binding strip is provided for the leaves, a portion of which is arranged to hold the fasteners in place, another portion being adapted to be held in binding engagement with the leaves of the book by means of the fasteners. The individual leaves have recesses so shaped that, when the fasteners are in position in the recesses of the leaves, these leaves will be held as firmly between the covers as if they were regularly bound therein. It is possible to remove any of the leaves from the covers or to introduce additional leaves.

CONCENTRATE-RECEIVER.—JOHN C. and RICHARD C. WATERS, Romley, Col. In concentrating machinery as hitherto employed, the concentrates are passed with the water from the machine into an ordinary box set on the floor, and are removed from the box by means of a hoe or shovel—a most laborious process. The box of the present receiver is mounted to turn and is formed with a flexible bottom separating the box into two compartments. The upper compartment is the receiving compartment. The box is mounted to move downwardly under the weight of the accumulating concentrates in the uppermost compartment. A device is provided by means of which the box is made to turn when moved downwardly.

THIMBLE THREAD-KNIFE.—ANNAH M. HUNTER, Paris, Ill., and LOUIS ILLMER, Jr., Washington, D. C. This invention is an improvement in thread-cutters designed to be used on an ordinary thimble. The thread-cutter has a cutting portion or knife, and a clasp to embrace the thimble, which clasp is composed of a helical coil, the length of which exceeds a circle, whereby the clasp is made to overlap in the direction of the axis of the helix. The clasp is formed of spring wire and may be easily forced over a thimble of any size.

BEDSTEAD.—JOSEPH W. EVANS, Haskell, Tex. The bedstead of this inventor has a rigid frame, suspended by four cords running over pairs of vertical and horizontal pulleys journaled in brackets attached to the ceiling and over fixed pulleys, and are also connected wth a slide carrying movable pulleys. A pull-cord runs on the movable pulleys and certain fixed pulleys, whereby it actuates the slide and hence applies traction to the several suspending cords to raise the bed to the ceiling.

VENTILATOR.—GUSTAV F. CRAMER, Portland, Ore. The ventilator of this inventor is adapted to operate on the vacuum principle—that is to say, it may be so acted upon by the force of the wind as to tend to create a partial vacuum in the shaft or other inclosed space below, whereby an ascending draft is created. The ventilator comprises a frame or open-sided hood, slats pivoted horizontally and eccentrically thereon, devices having a curved rim and secured to the slats, and wires or equivalents attached to and connecting the devices. The wind's blowing upon the slats on side of the hood will close or tend to close them, because the greater surface area of the slats lies below the pivots. Such movement will cause the opposite slats to open correspondingly, so that an upward draft in the chimney is induced by the partial vacuum produced on the open side of the hood. The inventor has added a small contrivance by which the hood can be entirely closed at will.

MUSIC-LEAF TURNER.—WILLIAM G. DE RAMUS, Prattville, Ala. This improved leaf-turner is adapted to be used in turning the leaves of music, or as a copy-holder for use by typewriters. The apparatus has a frame supporting the leaves. A longitudinally reciprocal carriage is mounted on the frame and has a shaft rotatable at right angles to the direction of reciprocation of the carriage. Fingers are carried by the shaft and are arranged to hold and release the leaves. A spring is coiled around the shaft, by which spring the fingers are pressed against the leaves. A device is attached to the carriage in order to regulate the tension of the spring.

Designs.

BASE FOR CALENDARS.—MAX RUBIN, New York city. The calendar designed by this inventor is made in the form of a flag, and is so constructed that the field of the flag containing, for example, the stars of the American ensign, will represent the dates, each date being inscribed in a star. The fields representing the various months may be torn off; or, they may be rotated by means of a roller to bring a new month into view, thus giving the appearance of a moving field.

WALL-PAPER.—HARRY WEARNE, Rixheim, Germany. The wall-paper forming the subject of this design has pictured upon it a continuous chain or string of roses, full and partially blown, and in the bud, together with foliage.

WALL-PAPER.—ARTHUR MARTIN, Paris, France. This design consists of a bouquet of roses encircled by festoons of ribbon intertwined with jasmine. The ribbon is connected with the stems of the bouquet. At intervals, the ribbon is formed with bows holding rose-buds.

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(7525) E. P. asks: 1. Is there any way in which a Geissler tube might be injured by too heavy a current from a static machine, other than by the admission of air into the vacuum through a puncture in the glass? A. The vacuum in a tube always rises during its use; so that after a longer or shorter time it becomes impossible to force sufficient current through it to excite it. This is due to the absorption of the matter remaining in the tube by the electrodes or by the walls of the tube. The tube may be improved temporarily by heating it either in an oven or by a spirit lamp, being careful not to heat it unequally and so crack it. The better way is to buy tubes with adjustable vacuum, several makes of which have been repeatedly advertised in our columns. Such tubes will last indefinitely. 2. How can I expel the moisture from saturated calcium chloride, so that it may be used again for drying purposes? A. We know no way except by heat. 3. Is white shellac varnish as good for the glass plates of a Wimshurst machine as the brown or orange shellac? A. White shellac is simply bleached, and will serve as well as brown to prevent the deposition of moisture on the plates of a static machine. 4. Is there any particular method of handling X ray tubes with a static machine that will prevent them from becoming punctured by the current passing through the glass? I have great trouble in this respect. A. Tubes are usually punctured because the vacuum becomes so high that the discharge finds it easier to go through air and glass than through the vacuum. Of course the remedy is to keep the vacuum down to its proper value. A tube must have a lower vacuum for use on a static machine than with an induction coil. Hence such machines break more tubes than do coils. The writer has tubes with adjustable vacuum which he has used nearly two years without trouble. 5. How many glass plates 22 inches in diameter would a Wimshurst machine require in order to give good effects in X ray work? A. Large machines are made with six and eight plates for piercing the thicker portions of the body. Less power than a good fat eight inch spark should not be considered. A twelve inch spark is none too strong for the thorax, head, or thigh.

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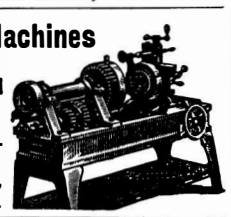

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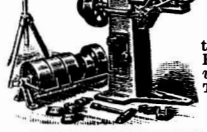

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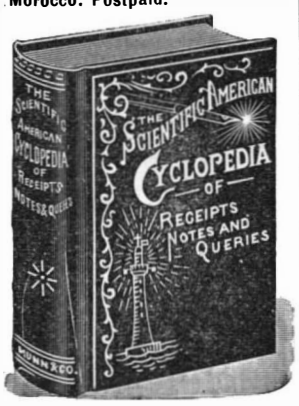

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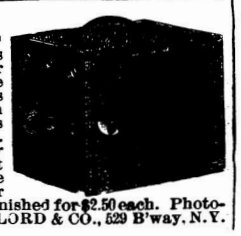

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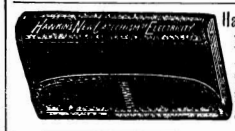

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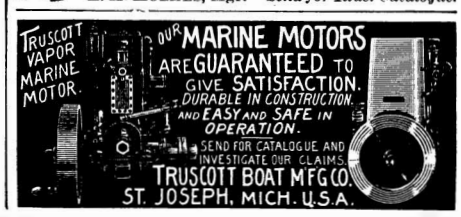
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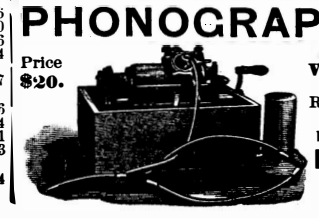

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